JPRS 79908

21 January 1982

USSR Report

ELECTRONICS AND ELECTRICAL ENGINEERING

No. 89

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50272-101

REPORT DOCUMENTATION PAGE	1. REPORT NO. JPRS 79908	2.	3. Recipient's Accession No.
4. Title and Subtitle USSR REPORT: ELECTRONICS AND ELECTRICAL ENGINEERING, No. 89			5. Report Date 21 January 1982 6.
7. Author(s)			8. Performing Organization Rept. No.
9. Performing Organization Name and Address Joint Publications Research Service 1000 North Glebe Road Arlington, Virginia 22201			10. Project/Task/Work Unit No. 11. Contract(C) or Grant(G) No. (C) (G)
12. Sponsoring Organization Name and Address As above			13. Type of Report & Period Covered 14.

15. Supplementary Notes

16. Abstract (Limit: 200 words)

The report contains articles, abstracts and news items on electronic materials, components, and devices, on circuit theory, pulse techniques, electromagnetic wave propagation, radar, quantum electronic theory, development and devices, miniaturization techniques on electric power machinery, power transmission, and nuclear power developments.

17. Document Analysis a. Descriptors

USSR
Antennas
Electromagnetic Spectra
Network Synthesis
Instruments
Lasers

b. Identifiers/Open-Ended Terms

c. COSATI Field/Group 9F, 9C, 9A, 20N

18. Availability Statement: Unlimited Availability Sold by NTIS Springfield, Virginia 22161	19. Security Class (This Report) UNCLASSIFIED	21. No. of Pages 81
	20. Security Class (This Page) UNCLASSIFIED	22. Price

(See ANSI–Z39.18)

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ANTENNAS

UDC 537.876:621.396.674.3

ATTENUATION FUNCTION FOR FIELD OF VERTICAL ELECTRIC DIPOLE ALONG PIECEWISE-HOMOGENEOUS PATH WITH TWO DIFFRACTING SHIELDS

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 26, No 7, Jul 81 (manuscript received 14 Jan 80) pp 1372-1381

ASTRAKHAN, M. I., IGNAT'YEV, V. A., KARATYGIN, V. A. and ROZOV, V. A.

[Abstract] Two ideally conducting metal bases are separated by earth with a characteristic complex dielectric permittivity retained on each side by an ideally conducting metal shield of a finite height. A vertical electric Hertz dipole is located on one of the bases. The attenuation of its field at some receiver point above the other base is calculated in the approximation of physical optics, with the aid of a probing dipole and by application of the Lorentz lemma with subsequent integration over the heights by the method of stationary phase. The solution to this problem of wave propagation past two diffracting shields must be further refined for receiver points in umbra and penumbra regions, such a correction being made by comparing it with the solution obtained according to the geometrical theory of diffraction. As the heights of both shields decrease toward zero and the receiver approaches the axis of symmetry, the solution reduces to that for a straight metal-earth-metal propagation path. Experimental data confirm these theoretical results, except for the effect of parasitic reflections on the attenuation function. Figures 5; references 8: 7 Russian, 1 Western.
[34-2415]

UDC 621.396.67

ELECTRICAL CHARACTERISTICS OF TURNSTILE ANTENNA WITH ZENITH RADIATION

Moscow ELEKTROSVYAZ' in Russian No 8, Aug 81 (manuscript received 1 Jul 80) pp 41-44

SHERED'KO, Ye. Yu.

[Abstract] Turnstile antennas with zenith radiation are used for local radio broadcasting in the decameter-wave range. Such antennas are built in two variants: unimodular and bimodular, the latter with radiation control through asynphasal excitation of the two modules. Here the performance characteristics are plotted

and tabulated on the basis of calculations in a spherical system of coordinates. The radiation patterns in three vertical planes (x0z, y0z, ξ0z corresponding to azimuthal angles $\varphi = 0, 90, 45(135)^{\circ}$ respectively) have been calculated for wavelengths from 55 to 80 m and the maximum gain in the zenithal direction has been calculated as a function of the wavelength over the 50-100 m range. In the case of bimodular antennas, the characteristics of asynphasal excitation with an 8.8 m eccentricity are compared with those of synphasal excitation (zero eccentricity). The effectiveness of directivity control is characterized by the relative gain, the maximum elevation of the main lobe, and level and elevation of the first side lobe - all depending on the eccentricity. Figures 10; tables 3; references: 1 Russian.
[79-2415]

UDC 621.3967.01

GEOMETROOPTICAL SYNTHESIS OF NARROW-BEAM CASSEGRAIN ANTENNAS

Moscow RADIOTEKHNIKA I ELEKTRONIKA Vol 26, No 9, Sep 81 (manuscript received 20 May 80) pp 1816-1818

KALOSHIN, V. A. and POPOV, A. P.

[Abstract] Cassegrain antennas with cophased distribution of the field in the aperture of the main reflector are widely used for forming narrow-beam directional diagrams. In so doing, the principal characteristics of such antennas depend on the distribution of the amplitude of the field in the aperture of the main reflector. A system of differential equations in partial derivatives of the third order is presented, which describes a transform of the wave front with a double reflection from the smooth surfaces. Solutions of this system makes it possible to synthesize a Cassegrain antenna of general form, which transforms the field of the excitation source into the required field on the aperture of the main reflector. It is shown that the problem of synthesis of Cassegrain antennas with axial and cylindrical symmetry is equivalent to solution of a system of ordinary differential equations of the second order. By numerical and other approximate methods the problems of Cassegrain antennas with axial and cylindrical symmetry were solved, which assures in the aperture of the main reflector a plane phase front with a specified amplitude of distribution in the case of a plane, cylindrical, and spherical front of the field of the excitation source. An analytical solution is obtained only for particular cases of distribution of the field in the aperture of the main reflector and the field of the exciter. In the present work the solution of these problem for an arbitrary exciter and distribution of the field in the aperture is reduced to the solution of one transcendental equation. For an antenna with a uniform distribution of the field in the aperture of the main reflector, a clear solution is obtained in quadratures. Figures 1; references 9: 5 Russian; 4 Western.
[73-6415]

UDC 621.396.677.494

RADIATION FROM CYLINDRICAL ARRAY THROUGH LAYER OF NONHOMOGENEOUS DIELECTRIC

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 26, No 7, Jul 81
(manuscript received 5 May 80) pp 1345-1349

BUBNOV, G. G., SERGEYEV, V. N. and KASHIN, S. V.

[Abstract] Diffraction of waves coming from a cylindrical antenna array by a radially nonhomogeneous dielectric annulus is analyzed in the approximation of geometrical optics. The annulus consists of concentric layers with the refractive index increasing from unity at the outside to values inversely proportional to the radius inside, its gradient being so small that its change over distances of the order of the wavelength remains negligible and the approximation of geometrical optics remains valid in the near field. The antenna array has a constant amplitude distribution and a controllable phase distribution. The radiation pattern is calculated on this basis with either a directional beam in the far field or with all elements of the array radiating simultaneously. Figures 4; references 5: 3 Russian, 2 Western.
[34-2415]

CERTAIN ASPECTS OF PHOTOGRAPHY, MOTION PICTURES AND TELEVISION

UDC 621.397.13:778.4

EXPERIMENTAL STUDIES PERTAINING TO STEREOCOLOR TELEVISION BROADCASTING

Moscow TEKHNIKA KINO I TELEVIDENIYA in Russian No 9, Sep 81 pp 46-49

DZHAKONIYA, V. Ye., DUKLAU, V. V., ZHEBEL', B. G., KOGANER, S. E., POLYANSKIY, Yu.G. and UKRAINSKIY, O. V., Leningrad Institute of Electrical Engineering of Communications imeni M. A. Bonch-Bruyevich

[Abstract] In the Soviet Union research on stereocolor television broadcasting began in 1949 at the Leningrad Institute of Electrical Engineering of Communications, and a system compatible with the existing network has been developed since 1961 under the guidance of professor P. V. Shmakov at the Department (Kafedra) of Television. In the prototype LEIS system first brightness signals of both images of the stereopair and then color-difference signals corresponding to the right-eye image of the stereopair were generated on the transmitter side. Two color-difference signals and one brightness signal of the right-eye image were transmitted over a communication channel to the receiver. The next step was adaptation to a standard television channel. One such system has been proposed consisting of two synchronously operating cameras and a commutator operating at twice the field frequency. Further improvements include conversion to and from black-and-white stereoscopic images and special anagliphic viewer's glasses. Such video signals were first recorded in 1975 and experimentally broadcast over the Leningrad TV network. Developments have also been made abroad: in a Japanese system the stereoscopic effect is achieved by means of a "Palfridis pendulum" and the American "Video West" principle of photography and cinematorgraphy serves as the basis for a single-objective television system with coding filters. Experimental stereocolor television programs with polaroidal signal coding were successfully broadcast from the Leningrad Radio and Television Center for the first time on 26 December 1979, featuring producer L. P. Krimskiy and editor V. F. Velyanina, then foι the second time on 20 November 1980. Further engineering research is underway, which should result in a steadily improving quality of stereocolor television broadcasting. Figures 6; references 14: 13 Russian, 1 Western. [76-2415]

UDC 621.397.23:621.395.44

EQUIPMENT FOR DIGITAL TRANSMISSION OF TELEVISION SIGNALS OVER TSL-Ts CABLE TRUNK LINES

Moscow ELEKTROSVYAZ' in Russian No 8, Aug 81 (manuscript received 21 Jan 81)
pp 6-12

SOLOV'YEV, V. M., PLOTKIN, M. A., LOPUSHNYAN, Yu. G. and GOLUBEV, A. N.

[Abstract] The equipment of TSL-Ts trunk lines is designed for digital transmission of television signals over KMG-4 coaxial cables, one cable pair for video signals and two cable pairs for audio signals. The equipment is energized from a 220 V - 50 Hz network. It consists of an encoder bay, a decoder bay, a sound track bay, and a bay with equipment for remote supply-control-inspection-measurement including line regenerators. The encoder includes an analog-to-digital conversion stage, an error correction stage with comparators, a sound track synchronization stage, and phasal automatic frequency control. Video signals at frequencies from 50 Hz to 60 MHz are linearly pulse code modulated in an 8-digit code with a 14.056 MHz discretization frequency and are transmitted at the rate of 114,048 kbits/s. Audio signals at frequencies from 30 Hz to 15 kHz are nonlinearly pulse code modulated in a 12-digit code with a 33.9 kHz discretization frequency and are transmitted at the rate of 509 kbits/s. The telemechanics equipment with an output voltage of 610 V provides a supply current of 500 mA to two digital channels over a distance of 40 km. The developers of this system thank V. I. Yanochkin, director of the Belorussian Republic Radio and Television Center, for the assistance in designing and testing the equipment. Figures 8; tables 3; references 4: 2 Russian, 1 Czechoslovak, 1 Internat'l.
[79-2415]

UDC 771.537.6

REPRODUCTION OF FREQUENCY-CONTRAST CHARACTERISTIC OF LUMINESCENT SCREEN FOR NON-SELECTIVE PHOTOGRAPHY FROM IMAGE OF INFRARED STEP SIGNAL

Moscow ZHURNAL NAUCHNOY I PRIKLADNOY FOTOGRAFII I KINEMATOGRAFII in Russian Vol 26, No 5, Sep-Oct 81 (manuscript received 12 Sep 80, final version received 19 Mar 81) pp 366-368

KLYUKIN, L. M., KOROLEVA, Ye. N. and SENASHENKO, M. V., All-Union Scientific Research Institute of Optico-Physical Measurements, Moscow

[Abstract] The feasibility of determining the frequency-contrast characteristic of a luminescent photoreceiver screen by a thermal or infrared method is examined, namely determined it from the response of the screen to a step signal, i.e., to the image of the step edge. This method of reproduction is found to be feasible, inasmuch as a relation between signal and response can be established analytically and verified experimentally, if the screen is isotropic with respect to its space

frequency characteristics and the response is a linear function of the signal. This conclusion is based on the definition of the frequency-contrast characteristic as the ratio of output signal to input signal Fourier transforms and on the solution to the equation of heat conduction for a thermal flux in the form of a step function with the appropriate boundary conditions. The feasibility was verified experimentally with equipment including an incandescent lamp, and IKS-7 light filter, an objective for producing a wide uniform light spot and a knife blade for covering one half of the spot at the black screen substrate. A polyethylene terephthalate film coated with the $AnS_{50}CdS_{50}$-Ag ($3\cdot10^{-4}$ g/g), Ni ($3\cdot10^{-6}$ g/g) crystal phosphor was used as the screen. The ultimate resolution, according to Rayleigh's criterion, was found to be 30 cm^{-1} and thus in agreement with earlier data and suitable for processing infrared signals. Figures 2; references: 5 Russian.
[67-2415]

UDC 772.932

THEORY OF GELATIN LAYER ACTING AS LIGHT MODULATOR

Moscow ZHURNAL NAUCHNOY I PRIKLADNOY FOTOGRAFII I KINEMATOGRAFII in Russian Vol 26, No 5, Sep-Oct 81 (manuscript received 28 Jun 79) pp 321-323

NEDUZHIY, S. A. and STATNIKOV, Yu. G., All-Union State Scientific Research and Design Institute of the Chemico-Photographic Industry, Moscow

[Abstract] A field-controlled gelatin receiver layer used as a light modulator is considered, such layers being used for immediate display of television images on large screens. The problem is solved here mathematically for the case of a ponderomotive force harmonically distributed over the surface of such a layer controllable by elasticity, with a corresponding strain distribution. Both compressibility and surface tension are taken into account in calculating the optimum space frequency of the applied force. The general solution obtained here is applicable to layers of any thickness and to their design optimization. With necessary measures to avoid large calculation errors, it is applicable to thin layers such as those used in Ruticon devices. Figures 1; references 5: 1 Russian, 4 Western.
[67-2415]

UDC 772.932

SENSITOMETRIC AND FREQUENCY CHARACTERISTICS OF SIGNAL RECORDING ON DEFORMABLE GELATIN LAYERS AND METHODS OF THEIR MEASUREMENT

Moscow ZHURNAL NAUCHNOY I PRIKLADNOY FOTOGRAFII I KINEMATOGRAFII in Russian Vol 26, No 5, Sep-Oct 81 (manuscript received 30 May 80, final version received 23 Jan 81) pp 360-361

ALEKHIN, V. A., GAVRILOV, V. M., GUSEV, V. V., GUSHCHO, Yu. P. and GORSHKOV, G. F., Moscow Institute of Radio Engineering, Electronics and Automation

[Abstract] An experimental study was made to evaluate the new method of surface topography, namely recording of electric signals on a gelatin layer with subsequent optical reproduction. The equipment specially built for measuring the performance characteristics of this process includes two sensitometers, one for periodic relief structures and one for arbitrary relief structures, also a pachymeter for measuring gelatin thicknesses from 0.1 to 10^3 um and a profilograph with a clearance regulation from 4 to 10^4 um. The signal voltage and frequency can also be regulated, the latter from 0 to 10^6 Hz. The contrast and the photographic latitude as well as the sensitivity were found to depend only slightly on the clearance between the free surface of gelatin and the control plane, but a change of the clearance was found to appreciably affect the sensitivity. The optimum carrier space frequency was found to be inversely proportional to the layer thickness, as had been predicted theoretically. The time frequency characteristics of a gelatin layer were found to be almost independent of the clearance width and of the voltage. Recording time and erasure time in this process are both $0.9 \cdot 10^{-4}$ s, and the capability of the equipment is over 10^{10} recording-erasure cycles. Figures 3; references: 1 Russian.
[67-2415]

UDC 778.5.004

DEVICES FOR DETERMINING FRAME FREQUENCY AND OBTAINING TIME COORDINATE IN HIGH-SPEED PHOTOGRAPHY (SURVEY)

Moscow ZHURNAL NAUCHNOY I PRIKLADNOY FOTOGRAFII I KINEMATOGRAFII in Russian Vol 26, No 5, Sep-Oct 81 pp 387-396

KONOVALOV, N. A. and LAKHNO, N. I.

[Abstract] The frame frequency and the time coordinate in scientific high-speed photography for the study of fast processes are determined either from measurements of the rotational speed of the camera mechanism with tachometers or transducers, or from the linear speed of the film tape. Chronometric data are obtained by registration of a clock or watch dial, a pendulum, or light flashes within the frame field, or by registration of a series of time markers on the film tape outside the frame field. Devices most widely used for these purposes include incandescent lamps, glow-discharge lamps, and cathode-ray tubes. Figures 10; references 43: 27 Russian, 16 Western (one in translation).
[67-2415]

UDC 778.37

DESIGN OF MIRROR-TYPE SCAN SYSTEMS FOR HIGH-SPEED PHOTOGRAPHIC CAMERAS WITH OPTOMECHANICAL IMAGE SWITCHING

Moscow ZHURNAL NAUCHNOY I PRIKLADNOY FOTOGRAFII I KINEMATOGRAFII in Russian Vol 26, No 4, Jul-Aug 81 (manuscript received 10 Oct 80) pp 274-279

BELINSKIY, A. V. and DUBOVIK, A. S., Moscow Institute of Geodetic, Aerial Photography and Cartography Engineers

[Abstract] A thick scanning mirror in high-speed photographic cameras causes a shifting of the image during exposure of a frame, which detracts from the quality of the image. Restoring the quality of the image requires an optimization of all associated camera components. Here the design procedure for a mirror-type scan system is shown in the most common practical situation with the surface of the rotating mirror element parallel to and the optical axis of the system perpendicular to the axis of rotation. Analytical relations between the relevant geometrical parameters are derived, taking into consideration that the image scanned by a thick mirror describes a Pascal's limacon in space. On the basis of these relations can be accurately calculated the angle φ_{min} determining the starting point of the scan, the distance L from object point A to the axis of rotation, the distance R from the axis of the mirror surface to the axis of rotation, and cos α ($\alpha = \sin^{-1} \frac{h}{L}$, where h is the distance from the optical axis of the system to the axis of rotation) which will yield the minimum image shift. Numerical design data are shown for two basic configurations. Figures 8; tablees 2; references: 3 Russian.
[66-2415]

UDC 778.182.4

DIMENSIONS OF RASTER LENSES AND DEPTH OF REPRODUCIBLE SPACE IN INTEGRAL PHOTOGRAPHY

Moscow ZHURNAL NAUCHNOY I PRIKLADNOY FOTOGRAFII I KINEMATOGRAFII in Russian Vol 26, No 4, Jul-Aug 81 (manuscript received 8 Aug 80) pp 292-294

IGNAT'YEV, N. K., All-Union Scientific Research Institute of Cinematography, Moscow

[Abstract] A problem of integral photography is considered, namely the dependence of the depth of the reproducible space on the dimensions of the raster lenses. An analysis of this relation, taking into account defocusing and scattering, indicates how the diameter of the raster lenses can be optimized for a change from a uniform but insufficient resolution to a redistributed but more adequate one with an inevitable reduction of the depth. Integral photography is found to degenerate into plain photography in two limiting cases: very large lenses reduce the depth to within the far-field zone and very small lenses reduce the depth to within the near-field zone. Figures 2; references: 2 Russian.
[66-2415]

CERTAIN ASPECTS OF RADIOASTRONOMY, SATELLITES AND SPACE VEHICLES

COMMUNICATION SATELLITES IN INTERNATIONAL SHIPPING

Moscow MORSKOY FLOT in Russian No 9, Sep 81 pp 52-54

[Article by Yu. Atserov, chairman, All-Union "Morsvyaz'sputnik" (Marine Satellite Communication) Association]

[Text] The nature of the work of the merchant fleet is defined on a global scale, and requires stable operational radio communication. Artificial earth satellites make it possible to support such communication in the "shore-satellite-ship" direction and back.

In the early 1960s, Soviet and American scientists and engineers created the "Molniya" and TELSTAR communication satellite systems, which operate with stationary facilities on the ground. Satellite systems for communicating with mobile platforms - seagoing vessels - appeared in the 1970s. For example, the MARISAT system was created in the US to support the Navy. In 1976 some of its channels were leased to civil users.

The most efficient utilization of satellites in shipping required that this matter be resolved on an international basis. Therefore, the Intergovernmental Marine Consultative Organization (IMCO) worked on this problem in 1966 within the framework of the Subcommittee on Radio Communication.

Based on a proposal of the USSR, a special group of experts on rights of the IMCO Committee was formed in 1972. This group developed a specific program for the use of communication satellites at sea, including the creation of a special international organization for controlling such a system. The USSR proposed a draft of Proposed Principles for the creation and activity of the organization, many of the points of which were then incorporated in the instituting documents.

In 1975, the first session of the IMCO Conference considered the draft of the Convention on International Organization of Marine Satellite Communication (INMARSAT). This draft provided the basis for developing drafts of the Convention and Operating Agreement concerning INMARSAT. These documents were accepted by the third session of the IMCO Conference in 1976. Fifty-four governments participated in the work of the conference. The Convention was signed by 15 governments, including the USSR, Ukrainian SSR, Belorussian SSR, the Bulgarian Peoples' Republic, the Polish Peoples' Republic, Great Britain, Norway, Greece, Japan and Iraq. The Convention went into force on 16 July 1979.

There are now 32 INMARSAT member governments.

The Council of the Organization consists of 22 members, with the membership of 18 based on percentage and 4 based on geographic distribution. The US (22.5%), USSR (14.174), England (9.949), Norway (7.924) and Japan (7.07%) have the greatest percentage participation.

The INMARSAT Council is the executive organ with voting established on a weighted bases: the weight of a vote corresponds to the share of the financial contribution of the government. The Council solves technical, operational, finance-economic and judicial problems concerning the creation of a space marine communication system. It meets at least three times annually.

The INMARSAT Directorate, headed by a Director General, provides day-to-day control. The Swede Olaf Lundberg was elected to this position in November 1979 and will serve in that position for 6 years. The headquarters of the Directorate is located in London.

The highest organ of INMARSAT is the Assebly, which convenes biannually. This body defines the general technical and economic policy of the activity of the Organization. Each government in the Assembly has one vote, regardless of percentage of participation, number of vessels or tonnage of national fleet.

In the Soviet Union the authorized organization defined by the government for solving technical-operational, financial and judicial problems concerning international marine satellite communication in the interests of our national economy is the All-Union "Morsvyaz'sputnik" Association attached to the Ministry of the Merchant Fleet. The Association represents the Soviet Union at INMARSAT and carries full responsibility for the activity of the Organization, being under the jurisdiction of the government of the USSR. The government of the USSR is not responsible for the financial-economic or technical-operational functions of the Association which it has designated.

During 1978-1980 the working organs of INMARSAT developed principles for the construction of the system and technical requirements for its components. A list of services was defined which the satellite service can make available to users: telephone channel services include telephone, facsimile, broadcast facsimile, medium-speed data transmission, slow-scan television, radio broadcast, and leased telephone channels; telegraph channel services include Telex, transmission and reception of telegrams, low-speed data transmission, broadcast telegraphy and leased telegraph channels.

The system provides priority processing of distress, safety and urgent messages. It must be noted that in INMARSAT priority messages, i.e., those which are preceded by a distress, safety or urgency signal, will be transmitted without charges. Various tests to check the operation of the shipboard installation will be transmitted without charge at the request of the shipboard installation. Tarriffs have been set for the use of telephone and telegraph channels, but these do not include the transmission of information via terrestrial long-haul facilities. It is planned to begin commercial operation of the system in 1982. The system uses relay satellites in geostationary orbit, i.e., an orbit in the equatorial plane at an altitude of about 36,000 kilometers. The satellites will be stationary with respect to an observer on the ground.

The International Administrative Radio Conference has allocated and assigned radio frequencies for marine satellite communication in the 4-6 GHz and 1.5-1.6 GHz bands. The three satellites provide practically global coverage of the earth (to 70° latitude), supporting 24-hour radio communication for all marine shipping regions, and for 4 to 5 hours daily between 70 and 82° latitude.

The space segment of INMARSAT will initially be configured as follows: a main "standing" point of 26° West longitude has been selected for the Atlantic Ocean area, with the MAREX (primary) INTELSAT-V (reserve) satellites; a main point of 63° East longitude has been selected for the Indian Ocean area, with the INTELSAT-V (main), MARISAT (leased for 1982) and MAREX (reserve) satellites; a main "standing" point of 157.5° East longitude has been selected for the Pacific Ocean area, with the MAREX (main), MARISAT (leased for 1982) and INTELSAT-V (reserve) satellite.

Receiving-transmitting and switching functions in the information channel between a ship at sea and a subscriber on land are carried out by marine communication satellite shore stations. In 1980, three already operating stations were ready to work in the INMARSAT system: South Barre and Santa Paula (US) and Yamaguchi (Japan). Sixteen other shore stations are in varying stages of completion: Mar del Plata (Argentina), Tangua (Brazil), Mi' Vilezh and Lake Kovigan ([?Cowchan?]) (Canada), B'yuund (China), Yejk (Norway), Alexandria (Egypt), Thermopylae (Greece), Fuchino (Italy), Ibaraki (Japan), and others. Two stations are being built in the Soviet Union, one in Odessa, which is to be put into operation in 1982-1983, and one in Nakhodka, which is to be put into operation in 1983-1984. The Odessa station will serve the Atlantic and Indian Ocean regions, while the Nakhodka station will serve the Pacific and Indian Oceans.

Shore stations are configured with a large variety of transceiving and switching equipment, combined with computer systems, which implement the following basic functions: transmission and reception of information, via satellite relays; interfacing with terrestrial long-haul communication links; automatic and semi-automatic control of satellite communication channel access; providing communication channels on demand on a priority basis (alarm, distress), automatic arrangement of channel allocation in case of maximum satellite loading; automatic monitoring of operation of satellite communication channels and Central Maritime Satellite Communication equipment, with automatic switchover to standby equipment.

The data rate for digital information is 1200 bps for transmission and 4800 bps for reception. Satellite channels can carry up to 40 simultaneous telephone conversations and 1976 telegraph connections.

When there are more than two shore stations in one service region, one of them acts as the network coordinating station (NCS). In order to ensure high reliability and serviceability, it is also advisable to have a backup NCS. In addition to the usual functions, the NCS also has these additional functions: transmission and reception of messages about allocation of satellite communication channels to vessels and ordinary shore Centers; formation of queues for the use of a telephone channel when the latter is busy, and processing of the queue; freeing satellite channels under priority conditions; documenting the use of satellite channels by corresponding shore centers and vessels.

The following coordinating stations have been announced: South Barre (US) for the Atlantic Ocean region; Yamaguchi (Japan) for the Indian Ocean and Ibaruki (Japan) for the Pacific Ocean. The shipboard installations are a major part of the system, and must be as simple as possible to operate, highly reliable, easy to repair and reasonably priced. About 400 installations were in use on various vessels and oil drilling platforms by the end of 1980. Their number is expected to increase significantly by 1985, and to grow further in the future.

The captain of a vessel obtains the capability of establishing a connection almost instantaneously (within an average of 25 seconds) with a Telex subscriber located anywhere in the world, regardless of radio wave propagation conditions or time of day or year. He can provide timely notification of port arrivals, and he can receive commercial and weather information on a 24-hour basis, and can consult with his superiors.

The sixth Session of the INMARSAT Council developed draft specifications for shipboard installations which support all of the types of services proposed for the INMARSAT user. Shipboard satellite installations are now being produced in the US, Japan, England, Germany, Norway and the USSR.

In terms of construction, shipboard installations are divided into equipment installed on deck - an antenna system with receiver and transmitter amplifiers, guidance and stabilization device - and equipment located in the radio room - electronic modules, modems, frequency synthesizer, terminal equipment and control panel. The shipboard installation operates around the clock in the standby mode without operator participation. A ship call is accompanied with information to set the station to the operating mode. A station is switched to the operating mode only in the direction of the NCS, which allocates a working communication channel for this purpose on request.

At the wish of the ship's captain, the shore station can check the integrity of the shipboard station, which responds automatically, 4 times a day. A shipboard satellite communication installation can be installed and wired aboard a vessel in port within 1 day, which does not require complicated transportation and freight operations. Experience has shown that a satellite communication installation does not create radio frequency interference for radio electronic equipment aboard a vessel, and is itself well protected against external interference from shipboard facilities. The weight and size specifications of a shipboard satellite communication installation, and the ability to interface it with the ship's power supply and various types of gyrocompasses, helps it to be placed conveniently on the deck and in the radio room.

Maritime satellite communication will make it possible to increase the timeliness of control decisions made by ship owners and issued to their ships. Timely reception of weather information will make it possible to reduce trip times and to increase the preservation of cargo and the vessels themselves by changing courses and sailing through regions in which the weather is good. Timely reception of needed commercial information makes it possible to minimize empty trips, to know when needed cargo is present in ports, and to make trips "on the short leg" in expectation of a load. Timely warning about the arrival of ships in ports makes it possible to avoid fines and ship waiting time for piers and loading or unloading crews.

Improved navigational safety thanks to immediate communication with national search and rescue centers in various countries will significantly reduce losses from ship accidents and damage to cargo.

As experience in operating satellite installations aboard Soviet and foreign ships indicates, savings of up to 1% of steaming time can be achieved through increased timeliness of fleet control. There is foundation to assert that the selection of optimal routes in consideration of radio weather forecasts received by the vessel makes it possible to save an average of at least 2% of the steaming time per run. Considering these factors, up to 3% of the steaming time can thus be saved. Expert evaluations indicate that the use of the maritime satellite communication system will reduce accident losses by 10% per year.

Summarizing all of the advantages, we can conclude confidently that the expenditures for acquiring and installing a shipboard satellite communication station ($60-70,000) can be paid back in less than 1 year of operation aboard the ship, while the prospects for the operating and technical capabilities of satellite communication provide a powerful impulse for progress in transport and commercial operations in the merchant fleet.

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CSO: 1860/36

UDC 629.78:621.396.67.01

SOME ASPECTS OF SELECTION AND DESIGN OF ANTENNA SYSTEMS FOR SATELLITE SOLAR ELECTRIC POWER PLANTS

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 26, No 7, Jul 81
(manuscript received 11 Feb 81) pp 1479-1487

ARMAND, N. A., LOMAKIN, A. N. and PARAMONOV, B. M.

[Abstract] The design of antenna systems for satellite solar electric power plants collecting cosmic energy and transmitting it to earth is considered, taking into account USSR standards with regard to safe levels of microwave radiation intensity. Transmitter and receiver arrays are designed essentially to meet a given optimum efficiency at a given power level and to match the permissible energy flux density on ground (10^2 W/m^2 in the US, 10^{-1} W/m^2 in East European countries). An important problem is suppression of parasitic side bands causing energy losses and interference. This can be achieved by including a huge number of nonlinear amplifiers in a phased antenna array, all connected in series and coupled through waveguides to slot radiators. Their performance characteristics can be optimized by numerical and graphical methods. Figures 6; references 7: 5 Russian, 2 Western.
[34-2415]

COMMUNICATIONS, COMMUNICATION EQUIPMENT, RECEIVERS AND TRANSMITTERS, NETWORKS, RADIO PHYSICS, DATA TRANSMISSION AND PROCESSING, INFORMATION THEORY

UDC 621.316.726.078

SYSTEM OF FREQUENCY-PHASE AUTOMATIC FREQUENCY CONTROL

Moscow ELEKTROSVYAZ' in Russian No 9, Sep 81 (manuscript received 5 Mar 80)
pp 48-51

KARYAKIN, V. L. and DRUGOV, M. I.

[Abstract] The present work is concerned with an investigation of the dynamic properties of a continuous model of an analog-digital system of frequency-phase automatic frequency control which contains two control circuits. A two-circuit system is used, in essence two interrelated systems of synchronization -- phase and frequency. The frequency alignment is accomplished with the aid of digital units. A block diagram of such a system is examined. It is shown that the required high-speed response with the specified parameters of the system provided is assured by the choice of the magnitude ρ. A considerable decrease of the time of the transient processes in the system can attain preliminary establishment of a reversible counter which assures a decrease of the amount of initial detuning. Three equations derived in the work show that an increase of ρ leads to an increase in the regions of stable state of the systems and a shift of the average value of the regulation errors from the switching line. This in turn reduces the probability of skipping of the phase difference. With fulfillment of the conditions $\rho \leq 2t\Omega y$ in a system of freedom from the initial conditions, a regime of synchronization is established. In a real system the hold range is limited by the maximum possible detuning, which can compensate the digital phase of control of the frequency of the oscillator being fine adjusted. Figures 4; references: 6 Russian.
[60-6415]

UDC 621.373.826.621.396

EFFECT OF TEMPERATURE ON ATTENUATION FACTOR AND NUMERICAL APERTURE OF OPTICAL FIBRE AND CABLE

Moscow ELEKTROSVYAZ' in Russian No 9, Sep 81 (manuscript received 17 Oct 80)
pp 28-30

VLASOV, A. V., INOZEMTSEV, V. P., KANUNNIKOVA, N. A., REVENKO, V. I. and
TUROV, V. G.

[Abstract] In order to evaluate the efficiency of optical communication cables (OC) under real conditions, it is necessary to know the change of their transmission characteristics, of which the most important are the attenuation factor of the optical signal α and the numerical aperture NA of the optical fibre (OF) as a function of the temperature. The present paper is concerned with the results of an experimental evaluation of the changes of α and NA in OF of various types and in OC constructed on their basis, as a function of the environmental temperature of $-60 \div 80^{\circ}$ C. Three types of OF were examined. A functional diagram of an experimental installation is shown and explained. The specimens of OF and OC with a length of 30-100 m wound on a Duralumin spool with a diameter of 188 mm were placed in a hot and cold chamber which assures maintenance and change of an assigned temperature in the limits $-60 \div 80^{\circ}$ C with a precision of $\pm 2^{\circ}$ C. The ends of the OF and OC specimens under test were removed from the limits of the chamber through a packing. Two specimens were simultaneously placed in the chamber. The change α of the optical signal in one of them was investigated with the aid of a decremeter. A superluminescent light-emitting diode with excitation from a 5 kHz oscillator was used in the decremeter as a radiator, and a FEU-28 photoelectric multiplier as a photodetector. The change of NA was investigated on the other specimen, for which at one end of the OF being tested radiation of a helium-neon type OKG 12-1 laser with $\lambda = 0.6328$ micrometer was introduced with the aid of a microobjective. The results of tests on the three types of OF are shown in the form of curves. On the basis of the results obtained, it is concluded that the experiments conducted confirmed the necessity for considering the temperature dependence of the attenuation factor of OF during development of the construction of OC. The optical cable produced on the basis of Type 1 OC can be applied to OC communication lines at a temperature of $-60 \div 80^{\circ}$ C, during which an increase of α in this area will not exceed 7 db/km. The range of the working temperatures for OC produced on the basis of Type 3 OF is restricted below $t = -50^{\circ}$ C with an increase of [illegible] at 50 dB/km. Figures 6; tables 1; references: 2 Western.
[60-6415]

UDC 621.376.52

DETECTOR OF RECEPTION QUALITY OF FREQUENCY-SHIFT KEYING SIGNALS

Moscow ELEKTROSVYAZ' in Russian No 9, Sep 81 (manuscript received after completion 9 Jul 80) pp 42-45

SKVORTSOV, V. S. and KHLOBYSTOV, V. A.

[Abstract] During transmission of discrete information by binary codes, reception of signals is accomplished with erasure which makes it possible to improve the statistical characteristics of the receiving devices. For this purpose a quality detector is introduced into the first computing circuit of the receiving device, which performs an analysis of the degree of reliability of each element of the signal, locating the elements received in the erasure zone (in the zone of uncertain reception). The results of such an analysis are subsequently used in the second computing circuit for acceptance of a final solution of the signal as a whole. The present paper considers one of the versions of the construction of a quality detector and shows the effectiveness of its operation. The basic circuit of the quality detector is presented and explained. The determination of probabilities is considered. It is shown that use of reception with erasure and the employment of interference-free codes with a minimum code spacing d makes it possible to correct in code combinations the errors of multiplicity $\leq$ d-1. An example, using a cylindrical code, is worked out. It can be shown that for channels of a different quality, an optimum width of the null zone exists, with which the maximum correcting ability is attained. However, this is a problem for a separate article. Figures 5; references 7: 6 Russian, 1 Western.
[60-6415]

UDC 621.376.56

MORPHOLOGICAL ANALYSIS OF MICROELECTRONIC MULTICHANNEL TRANSMISSION SYSTEMS

Moscow ELEKTROSVYAZ' in Russian No 8, Aug 81 (manuscript received 12 Jan 81) pp 16-19

ZUBAREVA, M. V.

[Abstract] Microelectronic multichannel transmission systems are analyzed from the morphological standpoint on the basis of a universal model and for the purpose of adaptation to large-scale-integration technology. The model encompasses all modes of communication with all types of signals and all forms of data presentation. In it the system appears as a chain of fourpole networks, with both grouping and individualization. It reveals the repeatability of functional components from channel to channel and facilitates a technoeconomically optimum breakup of a system into LSI chips. For illustration, the method of analysis is applied to IKM-12M 12-channel pulse-code-modulation equipment consisting of three optrons as matching and decoupling devices, two active low-pass

(ultralow-pass) filters, an analog-to-digital converter, a digital-to-analog converter, a modulator and a demodulator in each channel. Figures 6; references 14: 6 Russian, 8 Western (four in translation).
[79-2415]

UDC 621.391

EFFICIENCY OF RECURRENT DIGITAL ADAPTIVE TUNING ACCORDING TO CRITERION OF MAXIMUM SIGNAL-TO-NOISE RATIO

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 26, No 7, Jul 81
(manuscript received 14 Apr 80) pp 1438-1443

ABRAMOVICH, Yu. I., MIKHAYLYUKOV, V. N. and STRUCHEV, V. F.

[Abstract] A recurrent procedure for regularized adaptive tuning of a data processing system by the digital method is examined which uses the maximum signal-to-noise ratio as criterion. Specifically, inversion of the interference correlation matrix on the basis of a well known matrix identity relation is considered. An analysis of such a recurrent digital adpatation procedure reveals that its algorithm provides for a number of iterations equal to the number of acting interference sources which must be suppressed. This number of iterations and thus also the sample size needed for adaptation are much smaller than with the maximum likelihood as criterion. Increasing the number of digits in the mantissa will, furthermore, increase the supression factor. The procedure is particularly efficient when the number of interference sources and the number of iterations are smaller than the number of elements in the antenna array. The efficiency of the procedure as well as the number of iterations allowed for are, however, limited by the inevitable buildup of errors. Figures 6; references 9: 7 Russian, 2 Western.
[34-2415]

UDC 621.391.2

ACCURACY OF LOCATING RADIATION SOURCE BY SUBOPTIMAL SPACE-TIME PROCESSING OF SIGNALS

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 26, No 7, Jul 81
(manuscript received 10 Mar 80) pp 1425-1431

PON'KIN, V. A. and ROMANOV, A. D.

[Abstract] Locating a radiation source, namely determination of its distance and angular coordinates, in the Fresnel zone as well as in the far-field zone is considered on the basis of either optimal or suboptimal space processing of the dispersion of estimates. A comparative evaluation of the respective algorithms with respect to accuracy, taking into account the effect of frequency mismatch,

reveals that compensating both the lag of the signal envelope through the antenna aperture and the frequency mismatch between receiver and incoming signal will increase the accuracy of suboptimal processing. The drop of accuracy from that of optimal processing depends, moreover, on the width of the signal spectrum as well as on the dimensions of the receiver antenna and on its position in space relative to the radiation source. Figures 4; references 7: 6 Russian, 1 Western (in translation).
[34-2415]

UDC 621.391.23.019.4

ANALYSIS OF ASYNCHRONOUS METHODS OF DATA TRANSMISSION VIA CHANNELS OF DIGITAL TRANSMITTING SYSTEMS

Moscow ELEKTROSVYAZ' in Russian No 9, Sep 81 (manuscript received 3 May 79)
pp 39-41

BUDANOV, A. V. and KHARITONOV, V. Kh.

[Abstract] In connection with the intense development of digital transmission systems much consideration is given to an investigation of the possibility of discrete information transmission by digital channels. In particular, the accuracy of data transmission by such channels is of interest. Asynchronous methods for data transmission at low speeds have obtained wide circulation. These methods make it possible to organize the so-called "transparent" channels -- without limitation of the speed of transmission of various asynchronous signals and with the use of code. The present work explains the method of simple superposition, superposition with correction of single errors of a varying index with confirmation, which has obtained the widest dissemination among asynchronous methods. A time diagram of the recording of an individual unit transmitted by the superposition method is displayed and analyzed. During analysis of asynchronous methods for data transmission the case is considered when the duration of a recording pulse is below the repetition interval of the gating pulses. Taking into account equations derived in the work, the probability of error is calculated for various asynchronous methods for transmission of data by channels of digital transmission systems. An analysis of the results obtained shows that the method of superposition with correction of single errors is the most interference-free method because in this case all the breakdowns caused by individual pulses are eliminated: with similar introduced boundary distortions, the method of a varying index with confirmation is inferior with respect to noise immunity only to the method of superposition with correction of single errors, and, consequently its wide use is sound. Figures 1; tables 1; references: 8 Russian.
[60-6415]

UDC 621.391.82.016.35

INTERFERENCE IMMUNITY OF NONLINEAR 2-STAGE COMMUNICATION SYSTEM

Moscow ELEKTROSVYAZ' in Russian No 8, Aug 81 (manuscript received 30 Sep 80)
pp 55-58

MITRYAYEV, Ye. V. and TARASOV, V. M.

[Abstract] A model of a communication system is considered which consists of a sender station, a nonlinear relay, a receiver station, two transmission stages (one from sender to relay and one from relay to receiver), and an extraneous sender station producing interference. At the relay input is assumed to appear an additive mixture of a phase-manipulation signal from the sender, a single lumped interference signal, and a Gaussian sin-cos noise coming from the first transmission stage. Another independent Gaussian sin-cos noise coming from the second transmission stage will appear at the receiver input. The interference immunity of such a system is calculated on this basis in terms of the probability of incorrect detection, by the receiver, of a signal with phase manipulation. With the transfer characteristic of the relay approximated by a linear function and with conversion of amplitude modulation to phase modulation disregarded, this method of analysis yields results which agree closely, within 3%, with those obtained by conventional methods. Figures 2; references 8: 6 Russian, 2 Western. [79-2415]

UDC 621.391:621.396

REPLACEMENT OF SIGNAL DISCRIMINATION WITH SIGNAL ESTIMATION UNDER CONDITIONS OF INTERSYMBOL INTERFERENCE

Moscow ELEKTROSVYAZ' in Russian No 8, Aug 81 (manuscript received 30 May 80)
pp 58-61

KLOVSKIY, D. D. and SHIROKOV, S. M.

[Abstract] Optimum reception of discrete messages over channels with scattering at high transmission speeds, and with attendant intersymbol interference, involves minimization of the discriminating functional. In the case of long messages, with eight or more symbols in succession, such an optimum reception according to the maximum-likelihood criterion for signals submerged in Gaussian noise becomes uneconomical. A simple suboptimal algorithm of reception by analog demodulation is proposed, therefore, in which estimation of discrete quantities replaces their discrimination. Accordingly, the functional is minimized not in a space of Z^M M-dimensional vectors with components ± 1 but in a continuous real vector space R^M. A comparison of this algorithm with the optimal one and an evaluation of its interference immunity reveal that it is entirely adequate at typical transmission rates up to 4800 bits/s with moderate intersymbol

interference in tone-frequency channels, but becomes energy inefficient at higher transmission rates with stronger interference. References 5: 3 Russian, 2 Western (in translation).
[79-2415]

UDC 621.394.182.2

REDUCING INTERFERENCE BETWEEN IKM-120 AND K-60 SYSTEMS IN ONE COMMON CABLE DURING SIMULTANEOUS OPERATION

Moscow ELEKTROSVYAZ' in Russian No 8, Aug 81 (manuscript received 29 Jan 80) pp 20-23

BICHEV, G. A. (People's Republic of Bulgaria)

[Abstract] Simultaneous operation of an IKM-120 pulse-code-modulation digital system and a K-60 system with frequency division over a common MKS cable is considered. One effective method of reducing the interference from the IKM-120 channel to the K-60 channel is connecting a high-pass filter with a 12-13 dB attenuation below 250 kHz at the output of the last digital regenerator in the IKM-120 line. Here the dependence of the performance of both systems on the attenuation characteristic of the filter and the effect of its nonlinear phase-frequency characteristic on the performance of the IKM-120 system using a quasi-ternary code are analyzed, on the basis of the energy spectrum of a rectangular IKM signal and in terms of intersymbol distortion. The results indicate how the filter and the last segment of the IKM-120 line should be designed for minimum interference power. Figures 2; references 8: 4 Russian, 1 Czechoslovak, 1 East German, 2 Western (one in translation).
[79-2415]

UDC 621.394.3:681.3

LOAD DIVISION AT MESSAGE SWITCHING CENTER

Moscow ELEKTROSVYAZ' in Russian No 8, Aug 81 (manuscript received 20 Mar 79) pp 26-29

KLEPIKOV, V. P. and IVANASHEV, A. A.

[Abstract] The basic characteristics of message switching centers with standby are defined in terms of reliability. The most effective way to ensure continuation of an increasing load without increasing the probability of loss of messages is to change to load division with preferential message pickup and storage. Here the time constraints on realization of this mode are analyzed and the new transmission capacity is calculated. This method can be implemented on the message

level or on the control-data level. Here the algorithm of its implementation on the control level is demonstrated on a telegram processor. Tables 1; references 6 (Russian.
[79-2415]

UDC 621.394.763

ATK-20-U TELEGRAPH STATION OF IMPROVED CONSTRUCTION

Moscow ELEKTROSVYAZ' in Russian No 8, Aug 81 (manuscript received 16 May 79)
pp 34-37

BIKKARD, V. A. and ROMANTSOVA, L. D.

[Abstract] The automatic-switching telegraph stations ATK-MK-2 (1968 model) and ATK-20 (1971 model) have already become obsolete and should be withdrawn from service. Their replacement ATK-20-U has been developed at the Sverdlovsk branch of the Central Engineering Office. It can operate at a rate of 50-200 bauds, with up to 20 subscriber sets connected to it through either 2-wire or 4-wire lines and with the base station connected to it through eight channels. It requires a ±60 V power supply with a grounded center tap. Its transmission capacity is the same as that of the ATK-PD data transmission unit. It features an electronic pulser and signalizer built with semiconductor components, replacing the RPN electromagnetic relay and the DSD-2 synchronous motor, with a more reliable matching to the network and a more reliable fault detection. Its construction is of the unified type, with components mounted on both sides of removable and rotatable plates. Its overall dimensions are 2600 x 750 x 320 mm^3. Elimination of RPN relays and MKS cables has made it possible to manufacture the entire station at one plant, at an appreciable saving in production costs. Figures 2; references 5: Russian.
[79-2415]

UDC 621.395

MESSAGE DELIVERY TIME IN COMMUNICATION NETWORKS WITH MESSAGE SWITCHING

Moscow ELEKTROSVYAZ' in Russian No 8, Aug 81 (manuscript received 13 Jul 79)
pp 30-34

GINZBURG, S. L. and TOLCHAN, A. Ya.

[Abstract] An approximate model of queuing is used for estimating the message delivery time in a network with message switching. In this model all data processing components and channels are perfectly reliable, the message switching time is infinitesimally short, there is no delay in message pickup because of unavailability of free storage space or because of retransmission for error correction, and there is no possibility of loss of message in the network. At the

network terminals there are assumed to appear independent Poisson message fluxes, the length of a message not having changed along the route and messages being processed according to the "first come - first serve" principles. The message routing algorithm does not account for the length of messages and for the momentary state of the channel, but does account for the statistics of channel states. On the basis of this approximate model with an "invariable message length", the mathematical expectation and the dispersion of the message delivery time are calculated for an arbitrary distribution of message lengths, as well as the distribution function of message delivery times for an approximately discrete or gamma distribution of message lengths. An accuracy check based on specific network data indicates that these estimates are close within 10, 15 and 5% respectively. Figures 1; tables 2; references 5: 1 Russian, 4 Western (three in translation).
[79-2415]

UDC 621.395.74

INTERRELATION BETWEEN INTERURBAN TELEPHONE TELEGRAPH AND POSTAL MESSAGE FLUXES

Moscow ELEKTROSVYAZ' in Russian No 8, Aug 81 (manuscript received 14 Sep 78)
pp 24-26

SERGEYEVA, T. P.

[Abstract] The interrelation between message fluxes transmitted by interurban telephone, telegraph, and postal systems is analyzed for forecasting purposes. The analysis is based on the concept of a regional information demand index and on the directional or zonal distribution of message fluxes. With data collected in 1972 and then again in 1976 available, the three correlation factors (telephone-telegraph, telephone-post, telegraph-post) have been calculated for 32 territorial units (republics, krays, oblasts) of the USSR. Tables 2; references 2: 1 Russian, 1 Western.
[79-2415]

UDC 621.395.348

SUPPLEMENTARY SERVICE AS MEANS OF INCREASING QUALITY OF SERVICING SUBSCRIBERS

Moscow ELEKTROSVYAZ' in Russian No 9, Sep 81 (manuscript received 9 Apr 80)
pp 10-12

VOROB'YEVA, O. M., STROY, I. G. and SHESTAKOVA, L. B.

[Abstract] The paper is concerned with means for reducing recalls on telephone networks by the introduction into the network of supplementary forms of servicing. Introduction of supplementary services into existing types of automatic telephone stations (ATS) requires the development and installation of additional equipment, and because of this is not always found to be economically justified. In ATS

with control by a given program -- quasi-electronic and electronic -- introduction of supplementary service is a simpler problem because it is principally accomplished by programming means. Various forms of service are described which essentially do not raise the cost of a station, making it possible to take the first step in the direction of improvement of the quality of servicing, not because of an increase of the quality of the equipment but because of the more optimum construction of the algorithms of telephone servicing. In January 1980 test operation was completed on domestic specimens of rural quasi-electronic ATS of the YeSS ATs type which introduced a number of services such as "conference calls." This equipment is described in detail on pages 4-10 of the issue of ELEKTROSVYAZ' which contains the present paper. Test operation of the supplementary service of the YeSS ATs made it possible to check the stability of operation of programs which make this service available in real conditions, and the convenience of using procedures presented in specially prepared subscriber's directories, as well as to make clear the interests of subscribers in individual services. In the software of YeSS ATs stations, the possibility is established of the collection of statistical information concerned with calls lost because of the busy conditions and "don't answer" of subscribers as well as errors during dialing. References: 5 Russian.
[60-6415]

UDC 621.396.049.77:621.372.54.018.7

DEVICES FOR MATCHED FILTRATION IN DIGITAL COMMUNICATION SYSTEMS

Moscow ELEKTROSVYAZ' in Russian No 8, Aug 81 (manuscript received 6 Mar 80) pp 12-16

SMIRNOV, N. I., KARAVAYEV, Yu. A. and STRUCHKOV, A. A.

[Abstract] Matched filters of complex signals facilitate a fast synchronization in asynchronous digital address-type data transmission systems with code division. Linear (analog) matched filters with surface-acoustic-wave devices are used for signal processing at radio frequencies (1-1000 MHz) with a time delay up to 100 μs. Linear (analog) matched filters with charge-coupled devices are used for signal processing at video frequencies (below 10 MHz) with time delays from 0.2 μs to a few seconds. Discrete matched filters with digital components are used for signal processing at video frequencies, but with the maximum time delay and the number of elementary pulses in the receiver signal limited by reliability and power requirement only. Each filter consists essentially of a transversal filter in the form of a delay line with weighted output leads and a signal summator. Electronic tuning is usually effected by phase manipulation. Here the synthesis of programmable matched filters of each type is shown and the technology of producing them is described. Matched filters with surface-acoustic-wave devices can be built in either hybrid or monolithic form, matched filters with charge-coupled devices can be built on a single chip, and discrete matched

filters can be built with a large-scale integration by a technology analogous to that of multilevel integral injection logic. Figures 5; references 7: 6 Russian, 1 Western.
[79 2415]

UDC 621.396.61.019.3

EFFECTIVENESS OF RADIO TRANSMITTING DEVICE REDUNDANCY

Moscow ELEKTROSVYAZ' in Russian No 9, Sep 81 (manuscript received 17 Mar 80)
pp 34-37

GALOCHKIN, V. A. and PANAYEV, V. V.

[Abstract] In order to increase the reliability of operation of equipment at radio centers, a varying stand-by (so-called "channel redundancy") is frequently used. For a group of transmitters operating independently from one another, one stand-by is separated out. Interconnection of the operating transmitters in a given redundancy system is only accomplished through a stand-by transmitter and a restoration (repair) brigade. Evaluations of the parameters of reliability of similar redundancy systems for cases of limited and nonlimited restoration time, as well as for cases of duplication of devices, are given in the literature. However, the problem of determining the economically suitable relation of the number of operating and stand-by transmitters as a function of the reliability indices of the transmitters, which are united in a stand-by group according to the "channel redundancy scheme", requires an additional solution. In the present paper, an evaluation is made of the accrued running time to failure of a transmitter in a channel redundancy scheme with use of single-type transmitters and a limited restoration. A study of the effectiveness of redundancy is also conducted. From the technical and economic point of view it is shown that general redundancy has a strict limitation, both with respect to the number of transmitters united in a system with redundancy, and with respect to the value of the accrued running time at failure of each transmitter. The analytical relation presented in this paper makes it possible to determine the limits of application of varying redundancy for transmitting devices: the optimum and maximum permissible number of operating transmitters necessary at one stand-by unit, as well as the optimum and maximum permissible value of the accrued running time at failure of the stand-by transmitters. The recovery time is the most important technical index of a redundancy system: its reduction makes it possible sharply to increase the economic effect from redundancy and to increase the stand-by transmitters in a group with preservation of the economic effect. The relations obtained can also be used for analysis of the operation of other radioelectronics equipment. Figures 4; references: 3 Russian.
[60-6415]

UDC 621.396:621.376.24

OPERATIONAL CONTROL OF LINEARITY OF SINGLE SIDEBAND TRANSMISSION CHANNEL

Moscow ELEKTROSVYAZ' in Russian No 9, Sep 81 (manuscript received 10 May 78) pp 31-33

BURYAK, V. G., GOFMAN, V. A. and PETROVA, O. G.

[Abstract] In order to maintain the parameters of unipolar equipment during its operation in specified limits, it is possible to measure a restricted number of important, but insufficiently stable indices. Among these are the linearity of the amplitude characteristic of the single sideband of a transmitter, which basically also determines the quality of the signal at the transmitter output. The linearity of the amplitude characteristic of the equipment is evaluated according to the results of measurements of the nonlinear combination distortions (NKI). A test of the operation shows that on unipolar radio communications lines, where complex multifrequency signals are used for information transmission, operational control of the NKI of the transmitting channel is necessary before the beginning of a communication session, and sometimes also at the time of the session. The latter is necessary in the case of deterioration of the quality of operation of a radio communication channel, for the purpose of rapid determination of the section introducing distortions. Ordinarily, the operational control of the performance of the transmitting equipment is accomplished by maintenance personnel of the control-dispatcher point (KDP) of a radio center, where for these purposes the necessary measuring equipment and radio receiving devices are established. This assures reception from the air [ether] of signals of the controlled transmitters. Switching and control of the input low-frequency signals entering the radio center are accomplished in the same way. However, operational control of the performance of the single sideband of transmitters has been conducted to an insufficient extent. The NKI has not been controlled at the KDP because the existing control-measuring bays and the method of measuring NKI used in them appeared not to be acceptable for the conditions of air [ether] control. Consequently, the necessity arose for a search for a method of measurements of NKI, which assures the independence of the results of measurements on the amplitude-frequency characteristic of the inverse transformation device and does not require high precision of tuning of this device. The present work describes a method for measuring the nonlinear combination distortions. It is possible to consider practical realization of this method of measuring, using as an example a measurer of combination distortions (IKI) developed at the Union Center for Radio Broadcasting and Radio Communications No 1 and manufactured in small quantities. A block diagram of the unit is discussed. Measurement of nonlinear combination distortions of the single sideband of an IKI-1 device is considered. It is concluded that the method of measurement of NKI described makes it possible significantly to simplify the measuring device and which is more important, to lighten and to expedite the process of measurement, and make it possible to accomplish air [ether] control of this important index of a transmitting single sideband channel. Figures 3; references: 2 Russian.
[60-6415]

UDC 621.396.668:621.327.8

SINGLE-SYMBOL BEAT SYNCHRONIZATION OF MULTICHANNEL MODEM

Moscow ELEKTROSVYAZ' in Russian No 9, Sep 81 (abstract received 31 Jul 79) pp 45-47

BURAKOVSKIY, A. Z.

[Abstract] An algorithm of a device for beat synchronization (DBS) is introduced, an experimental analysis of which was conducted on the basis of a DBS in accordance with an operating signal, the most frequently used in known multichannel radio modems (MOdulator-DEModulator). A block diagram of the DBS and an algorithm of its operation are presented. The operations performed in a device for single-symbol beat synchronization (DSBS) are listed. The results obtained make it possible to judge concerning the advantages of DSBS in the area of improvement of the values t_B, t_T and the noise immunity of reception as a whole in comparison with one of the known two-symbol devices of beat synchronization of multichannel modems with orthogonal signals. Figures 3; references: 3 Russian.
[60-6415]

UDC 621.396.969.182.3:550.388.2

ACCURACY OF MEASUREMENT BY TWO-BASE PHASE DIRECTION FINDER OF RADIO WAVE ARRIVAL ANGLES

Moscow ELEKTROSVYAZ' in Russian No 9, Sep 81 (manuscript received 4 Dec 80) pp 37-38

LUGANIN, V. A. and SOKOLOV, V. I.

[Abstract] As shown in the literature, phase direction finder systems are widely used at present for measurement of the arrival angles Δ and the azimuth α. It is known that the precision of a phase direction finder is influenced by the locality surrounding it. However, it is not always possible to improve the conditions of the arrangement of the direction finder on the locality. The present work is concerned with an evaluation of the precision of a direction finder located in a slightly intersected wooded locality and intended for measurement of the angles of arrival of pulse signals, the frequency range of which $f = 10 \div 20$ MHz, angle $2^\circ \leq 20\text{-}25^\circ$, $|\alpha| \leq 3\text{-}5^\circ$. This case corresponds to measurement of the arrival angles of the principal (single-step) regular modes on the routes of oblique transmission of small and average lengths (1500--3000 km). Questions of errors connected with limitations on the methods of separation of modes fall outside the limits of this paper. Basic information concerning the phase system and the method of calibration of the direction finder are discussed. It is shown that calibration of the direction finders by the sounding balloon method guarantees a satisfactorily high precision ($|\delta\Delta_k|, |\delta\alpha_k| \leq 1^\circ$) of measurement of arrival angles of decameter signals with azimuths $|\alpha| \leq 3 \div 5^\circ$ only in

the subrange of medium arrival angles ($\Delta \geq 10^{\circ}$); with small angles of Δ the potentialities of the direction finder (with respect to precision) are limited. Figures 2; references: 4 Russian.
[60-6415]

UDC 681.846.7

MAGNETIC RECORDING IN DEVICES FOR AUTOMATIC FEED OF INFORMATION BY COMMUNICATION CHANNELS

Moscow ELEKTROSVYAZ' in Russian No 9, Sep 81 (manuscript received 12 Jun 78) pp 15-18

DOBROVOL'SKIY, V. V., KUSHMANOV, I. V. and ORLOV, V. G.

[Abstract] Development of the technique of magnetic recording lead to the creation of a whole group of devices which differ both by the construction of the operating mechanisms and by the form of an applicable recording medium. One of the varieties of devices of this type is equipment for automatic supply of information by communication channels (radio, wire). In equipment of this type it is necessary to give rise to an increasing volume of reference and other information, the operational delivery of which to the consumer is a pressing problem. A number of requirements are imposed on automatic information devices, taking into account the specific properties of their operation. An increase of the operating resources of these devices, which is connected with the necessity of continuous exploitation over a long period of time, occupies the central place among them. Principal attention must be given during this to the pair "head-carrier," the reliability of which primarily determines the operating resources of the device as a whole. The paper discusses the following items: 1) Choice of form and type of magnetic carriers; 2) Means for protection of operating surface of head-carrier pair; 3) Forming of data processing messages; and 4) Redundancy of transducers of vocal messages. It is shown that the automatic information devices considered in the present paper have a serviceability which makes it possible to use them for transmission of a variety of data processing programs on large scale communication networks. Data concerning Soviet and foreign devices for automatic feeding of information are shown in a table. It is seen from the table that the principal parameters of the Soviet devices for automatic feeding of information are close to the parameters of similar devices produced abroad. With a further development of this form of technology in the USSR it appears advisable to limit the list of such devices produced, after making them fit for a purpose, and establishing a specific use for them in determined areas of reference-information service. Figures 6; tables 1; references 13: 11 Russian, 2 Western in translation.
[60-6415]

COMPONENTS AND CIRCUIT ELEMENTS, WAVEGUIDES, CAVITY RESONATORS AND FILTERS

UDC 621.316.722.1.001.5

CHARACTERISTICS OF THYRISTOR CHOPPER WITH NONLINEAR INDUCTANCE IN ACCELERATED RECHARGING CIRCUIT

Novocherkassk IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: ELEKTROMEKHANIKA in Russian No 7, Jul 81 pp 795-801

LAYER, V. P. and MISHIN, V. N.

[Abstract] A DC saturable reactor can be used in an accelerated recharging for a thyristor DC chopper to control the time available for resetting the thyristor as a function of the load current, which in turn has an impact on the external characteristics of the converter. A simple initial circuit is analyzed which uses resistive setting of the initial inductance, but suffers the drawbacks: 1) The remagnetization of the saturable reactor to the initial state takes in the time for a pulse, which has a negative effect on the converter control range; and 2) There are power losses in the resistor and they increase in step with the regulation depth. An improved circuit design using an autotransformer configuration for the saturable reactor is analyzed and checked experimentally. The good agreement between experiment and theory is illustrated graphically with curves showing the external characteristics of the two types of choppers, the recharging current amplitude in the switching circuit as a function of the load current and the thyristor reset time as a function of the load current. Figures 5; references: 4 Russian.
[32-8225]

UDC 621.372.54

ACTIVE WIDE-BAND PIEZOELECTRIC FILTER

Moscow ELEKTROSVYAZ' in Russian No 10, Oct 81 (manuscript received 25 Feb 81) pp 54-58

ZELYAKH, E. V. and NOVIKOV, A. A.

[Abstract] As is known the width of the passband of piezoelectric filters is limited by the relative width of the frequency interval (the so-called resonance gap) of a piezoelectric resonator. Induction coils are ordinarily used in order

to widen the passband of piezoelectric filters. However, their presence in a circuit hinders miniaturization of filters. Known circuits of active equivalents of wide-band piezoelectric filters, where operational amplifiers or gyrators are used as active elements, do not have this shortcoming. In the present paper a method is presented for obtaining wide-band piezoelectric filters, which is based on widening the resonance gap of a piezoelectric resonator with the aid of negative capacitance. This combination was suggested by the authors in a 1978 paper. The following items are discussed in detail: 1) Theoretical premises; 2) Circuits of wide-band filters; 3) Order of calculations; and 4) Example of calculation and experiment. Figures 4; tables 2; references 7: 6 Russian, 1 Western. [107-6415]

UDC 621.372.82

LUMPED INHOMOGENEITY IN MULTIMODE WAVEGUIDE

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 26, No 7, Jul 81
(manuscript received 4 May 79, after revision 25 Dec 80) pp 1405-1413

KURASHOV, A. G.

[Abstract] Various built-in components of multimode waveguides constitute lumped inhomogeneities with specific characteristics which must be considered in the design. An important property of such inhomogeneities with dimensions smaller than the wavelength is that they do not reflect waves and transform modes at certain critical frequencies. This is demonstrated in an analysis of scattering versus reflection at a critical frequency for a small post in a rectangular waveguide, where the current excited in the post by an incident wave of a fundamental mode becomes a source. Calculations for frequencies near a critical reveal that the reflection coefficient is purely real above and purely imaginary below. The maximum reflection coefficient, at a resonance, and thus also the minimum transmission coefficient are determined taking into account the frequency characteristics of a given wave field and also the mode transformation which takes place. Experimental data are shown pertaining to cylindrical posts in a rectangular waveguide, also to a transition from a rectangular waveguide with a longitudinal slot to a circular waveguide. Figures 3; references 7: 6 Russian, 1 Western. [34-2415]

UDC 621.372.852.1

DIRECTIONAL 6-BAND WAVEGUIDE FILTER

Moscow ELEKTROSVYAZ' in Russian No 8, Aug 81 (manuscript received 9 Feb 81)
pp 48-50

SAVITSKIY, A. Yu.

[Abstract] A directional waveguide filter with a Chebyshev rather than maximally flat frequency characteristic of the reflection coefficient has been synthesized for combined filtration of six 34 MHz wide bands with the center frequencies spaced 50 MHz apart, within the 4 GHz range. It consists of a band filter in the form of five resonator cavities with direct coupling connected through a waveguide tee in the E-plane to a rejection filter consisting of three coaxial resonator cavities, the latter coupled to a common waveguide segment through bar vibrators. An experimental prototype of this device has been tested, the standing-wave voltage ratio and the attenuation were measured. The former was found not to exceed 1.1 at the input and 1.2 at the outputs of the band filter. The decoupling between bands is at least 22 dB, at a ±33 MHz frequency deviation from one center frequency, and the attenuation within each band is at most 1.5 dB. Figures 4; references 3: 2 Russian, 1 Western.
[79-2415]

CONFERENCES, SEMINARS, EXHIBITIONS, SYMPOSIUMS

UDC 62-83:061.3

ALL-UNION CONFERENCE ON AUTOMATED LINEAR AND MAGNETOHYDRODYNAMIC ELECTRIC MOTORS

Moscow ELEKTRICHESTVO in Russian No 7, Jul 81 p 78

SHINYANSKIY, A. V., candidate of technical sciences, and LAUGIS, Yu. Ya., candidate of technical sciences

[Abstract] A conference on automation of linear and MHD electric motors was held in Tallinn, 3-5 February 1981, under the auspices of the Ministries of Higher Education of the USSR and ESSR, the Tallinn Polytechnic Institute, the Moscow Power Engineering Institute and the Scientific Research Institute of Electric Drives. The conference was chaired by prof. Kh. A. Tiysmus. It covered developments and progress in high-speed transportation generally and specifically the use of linear induction motors for this purpose. It also covered linear high-precision stepper motors for data processing equipment and MHD motors for metallurgical processes such as casting. Theoretical as well as practical aspects of design and application were discussed. Several deficiencies in the program became apparent in the course of this conference, namely: a lack of interor organizational coordination, a theoretically inadequate and insufficiently thorough elaboration of several relevant control problems, a lack of standard terminology and design procedures, a too slow development of special-purpose control components, and an inadequate instruction program at the academic institutions for students specializing in this field.
[30-2415]

UDC 621.316.86(049)

ALL-UNION SCIENTIFIC-TECHNICAL CONFERENCE ON USE OF 'BET-EL' POWER RESISTORS AND RESISTOR BANKS IN ELECTRICAL POWER ENGINEERING

Moscow ELEKTRICHESTVO in Russian No 7, Jul 81 pp 76-77

KOVALEV, B. I., candidate of technical sciences, and MANCHUK, R. V., candidate of technical sciences

[Abstract] A new composite material, namely an electrical-grade concrete, has been developed at the Siberian Scientific-Research Institute of Power Engineering in a joint effort with several other organizations including the Scientific

Research Center for High-Voltage Equipment and the Institute of Physics at the AzSSR Academy of Sciences. Its electrical resistivity ranges from 10^{-1} to 10^5 ohm-cm, technologically controlled, and its toughness reaches already 1000 (N•m)/cm^3 in electric fields of 200-1500 V/cm intensity. A conference on its uses was held in Novosibirsk, 24-27 June 1980, in which materials for 26 reports were presented by 22 organizations. The major applications for these resistors are as shunting devices in circuit breakers, where their performance is enhanced by an almost complete absence of stray inductance, also limiting transient and fault currents in transformer and autotransformer neutrals, limiting overvoltages, and improving the dynamic stability of electric power systems. They have been used experimentally for electric braking in two hydroelectric power plants (Zeyskaya and Sheksinskaya), and in one regional electric power plant (Konakovaskaya) for advance shunting of 220 kV substation busbars to limit the recovery voltage after opening of circuit breakers following a short circuit. Further possible applications include longitudinal compensation and static compensation in capacitive dischargers. So far no adequate method of reliability analysis is available for these "bet-el" resistors, nor are they used in the manufacture of electrical equipment at enterprises of the USSR Ministry of the Electrical Industry. Further research, development and planning should be done during the period of the 11th Five-Year Plan.
[30-2415]

UDC 62-83:621.314.26.07

DIGITAL CONTROL OF THYRISTOR-PULSE D.C. CONVERTERS

Moscow ELEKTRICHESTVO in Russian No 7, Jul 81 (manuscript received 17 Oct 79) pp 38-43

YEFREMOV, I. S., doctor of technical sciences, and KALINICHENKO, A. Ya., candidate of technical sciences, Moscow

[Abstract] Digital control of thyristor-pulse d.c. converters for electric drives is considered, a binary system being preferable and most easily realizable. Bistable triggers are used as both counter and memory components. More than two information-carrying states can be established, without changing the number of digits, through formation of Walsh functions and their multiplication or with multiplication of the Rademacher function. This requires a reference-frequency generator and a decoder as well as a reversible counter. The system includes also a control generator for addition and subtraction. The operation of such a system is analyzed, whereupon its performance is evaluated in terms of regulator discretization and switching characteristics. Figures 6; references: 7 Russian. [30-2415]

CRYOGENICS AND SUPERCONDUCTIVITY

UDC 537.312.62:621.313.323.323.001.4

CRYOGENIC ALTERNATING CURRENT ELECTRIC MOTOR WITH SUPERCONDUCTING FIELD WINDINGS

Moscow ELEKTROTEKHNIKA in Russian No 8, Aug 81 (manuscript received 5 Dec 80) pp 11-14

SHEREMET'YEVSKIY, N. N., associate member, USSR Academy of Sciences, PLESHCHUNOV, N. N., candidate of technical sciences, VESELOVSKIY, A. S., engineer, RUBINRAUT, A. M., candidate of technical sciences, KRUGLIN, V. A. and SAMOYLOV, S. F., engineers

[Abstract] The present paper is concerned with work on the creation of production prototypes of cryogenic alternating current electric motors with superconducting field windings for reversing systems of electric drives (e.g., for a rolling mill), as well as an investigation of such machines. The basic technical data for a cryogenic motor with a power of 200 kW with superconducting field windings is shown as well as photographs of the armature of a cryomotor, and a cryostat with a superconducting field winding. The brief enumeration given of the special features of an alternating current cryogenic motor indicates the advisibility of a thorough investigation of electric motors of such a type with the object of introducing them into industry. Figures 3; references 4: 3 Russian, 1 Western. [84-6415]

UDC 621.313.3

COMPENSATION CONDITION FOR ROTATIONAL MOMENT OF SUPERCONDUCTING EXCITATION WINDING OF HIGH-POWER QUIET-RUNNING ELECTRIC MOTORS

Novocherkassk IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: ELEKTROMEKHANIKA in Russian No 7, Jul 81 (manuscript received 10 Jul 78, after completion 16 Jul 80) pp 735-741

NASEDKIN, L. P.

[Abstract] Problems inherent in single rotor synchronous and asynchronous machine designs, in which the rotor with the superconducting excitation winding is coupled to the output shaft, resulting in the electromagnetic forces being applied directly to the superconducting winding, can be circumvented by placing an additional

"thermal" excitation winding on the rotor which is 90° out of phase with the main one. This compensates for the transverse stator field and eliminates the impact of the rotating moment on the superconducting winding, but suffers from certain defects: when the load changes, it is necessary to change the excitation of both windings, which is hard to do with the superconducting winding; the coupling of the rotating moment is accompanied by a considerable heat influx via the machine shaft to the superconducting winding, which increases the consumption of coolant. A dual rotor machine avoids all of these difficulties. This design has a stationary stator with a conventional multiphase armature winding, a hollow rotor and a freely rotating superconducting rotor inside the latter. The cryostat design is simplified and the additional heat losses due to eddy currents in the internal shield and superconducting material related to the change in the magnetic field in the region of the superconducting winding are reduced. The hollow working rotor has a supplemental excitation winding at normal temperature or a short-circuited squirrel cage of one form or another as well as a phase winding which is brought out to the commutator ring. This configuration is analyzed to ascertain the requisite condition for the absence of any influence of the rotational moment on the superconducting excitation winding: the compensation of the transverse field of the stator. Analytical expressions are derived for the design of the supplemental excitation winding and the relevant vector diagrams are drawn. The results of sample calculations for 5 different moror ratings are summarized in a table for a 6.3 KV motor with overall power requirements of from 436 to 1,152.6 KW. Figures 4; references 5: 2 Russian, 3 Western.
[32-8225]

UDC [621.313.013.8:537.312.62].066.6.001.5

OPERATING SPECIAL FEATURES OF SLIDING CONTACT IN ELECTRIC MACHINES WITH SUPERCONDUCTING SYSTEM

Moscow ELEKTROTEKHNIKA in Russian No 8, Aug 81 (manuscript received 30 Oct 80) pp 14-16

KALASHNIKOV, V. K., KRUGLIN, V. A., PONOMAREVA, A. A., engineers, RUBINRAUT, G. N. and FRIDMAN, G. N., candidates of technical sciences

[Abstract] An investigation is made of the use of various contact pairs in electric machines with superconducting systems of excitation. A bar chart is presented of the electrical and mechanical contact losses in various sliding contacts. The principal properties of the contact pairs developed are shown in a table. Calculated data are presented in another table for motors with a power of 10,000 kW. One of the contact pairs of sliding contacts can be selected for each of the versions of a motor considered. The ratio of the magnitudes of the absolute losses in the units of the current pickoffs of the indicated machines with various contact pairs are given. The investigations made show that creation of a pair of sliding contacts for cryogenic machines for collector, unipolar and rectifier use opens a real possibility for development of such machines with stationary cryostats. Figures 1; tables 2; references 6: 4 Russian, 2 Western.
[84-6415]

UDC 621.372.832.0.29.6:537.312.2

ULTIMATE CHARACTERISTICS OF WIDEBAND MIXER ON JOSEPHSON JUNCTION WITH EXTERNAL PUMPING

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 26, No 7, Jul 81
(manuscript received 28 May80) pp 1554-1563

ZAVALEYEV, V. P. and LIKHAREV, K. K.

[Abstract] The performance limits of a wideband Josephson-junction mixer with external pumping, for step-down frequency conversion, are established on the basis of its equivalent circuit diagram and current-voltage characteristic. The noise temperature, its main performance indicator, is calculated as equal to the effective temperature at which the spectral density of the low-frequency output voltage fluctuations becomes equal to the spectral density of the converted intermediate-frequency signal in the double-sideband mode of operation. An asymptotic expression is used for the dimensionless noise temperature (referred to the physical junction temperature) in the high-frequency approximation and in the approximation of small pumping amplitude, in terms of mixer design parameters. These can not be optimized on this basis so as to yield the minimum noise temperature. Numerical results are shown for the case of an input power far below the mixer saturation level. They are somewhat pessimistic, they yield worse mixer characteristics and too high values for the noise temperature. Figures 4; references 15: 4 Russian, 11 Western.
[34-2415]

UDC 621.373.029.6:537.312.62

BIJUNCTION SUPERCONDUCTING QUANTUM INTERFEROMETER AS JOSEPHSON MICROWAVE OSCILLATOR

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 26, No 7, Jul 81
(manuscript received 29 Feb 80) pp 1545-1553

DANILOV, V. V. and LIKHAREV, K. K.

[Abstract] The performance of a bijunction superconducting quantum interferometer as a Josephson microwave oscillator is analyzed theoretically, of particular interest being the conditions of synchronism. The fundamental relations are established on the basis of the equivalent circuit diagram and including the effect of the external magnetic field. The oscillation characteristics are first calculated without accounting for intrinsic fluctuations in the junctions. The effect of the latter is then evaluated separately, as is the effect of additional shunting with a frequency-dependent admittance. Synchronism and coherence are found to be maintained as long as the inductance of the ring remains below its "fluctuation level" (approximately $2 \cdot 10^{-9}$ H at 4.2 K). The authors thank L. S. Kuz'min, V. V. Migulin and G. A. Ovsyannikov for discussion of the work.
[34-2415]

ELECTRICAL ENGINEERING EQUIPMENT AND MACHINERY: APPLICATIONS AND THEORY

UDC 621.313.292

RECTIFIER ELECTRIC MOTORS: STATE AND PROSPECTS

Moscow ELEKTROTEKHNIKA in Russian No 8, Aug 81 (manuscript received 8 Sep 80) pp 38-41

OVCHINNIKOV, I. Ye., doctor of technical sciences, LEBEDEV, N. I., LEVIN, V. N., candidates of technical sciences, engineers, VOSKRESENSKIY, A. P., candidate of technical sciences and KAZNACHEYEV, V. A., engineer

[Abstract] Commutator motors in a complex with semiconductor rectifiers are principally used in varying electric drives. In those cases where the commutator motors do not assure the requirements imposed on them, noncommutator motors (asynchronous and synchronous) are used in conjunction with semiconductor transformers, which, however, do not always satisfy the requirements imposed on their control properties, overload capacity and other items. Rectifier motors (RM) combine in themselves the high reliability of noncommutator alternating current machines and the good regulating characteristics of direct current commutator machines. RM having low powers are series produced in the USSR, experimental work is conducted, and production is mastered of motors with a power up to several thousands of kilowatts. Rectifier electric motors consist of electromechanical and electrical parts, a block diagram of which is shown. The present work primarily considers problems of designing the machine part of the RM from the point of view of the economic advisability of their industrial utilization. In order to determine the optimum design scheme of the RM, 6 prototypes of motors were developed with powers from 5.5 to 50 kW, the basic technical indices of which are shown in a table. A number of conclusions are drawn from an analysis of the data in the table. The results of the work described in the paper makes it possible to speak of the necessity of development and very rapid introduction of controlled rectifier motors. However, because of the novelty of the problem, a general point of view has still not developed as to the most efficient design and electric circuit as a function of the purpose of the motors or their unification with existing production. Work by P. A. Suysk, N. P. Advolotkin, V. P. Tolkunov, V. L. Frumin, V. D. Dobrovol'skiy, A. Ye. Chebit'ko and V. S. Yeremeyev is reflected in the presented paper.
[84-6415]

UDC 622.61:622.817.001.24

DETERMINATION OF POWER OF INTERNAL ARC SHORT CIRCUIT IN EXPLOSIVE-PROOF ENCLOSURE

Moscow ELEKTROTEKHNIKA in Russian No 8, Aug 81 (manuscript received 12 May 79) pp 43-46

TORGASHOV, V. S., MNUKHIN, A. G., PESOK, S. A., candidates of technical sciences, IKHNO, S. A., KONEVSKIY, B. I. and TOVSTIK, Yu. V., engineers

[Abstract] In accordance with "Safety Regulations in Coal and Shale Mines" in underground mine workings which are dangerous with respect to gas or flame, it is necessary to use mine explosive-proof electrical equipment with various levels (as a function of the position of its installation) of explosive protection. An investigation of the effect on the instantaneous power of a short circuit of the electrical parameters of a network, and the special features of the equipment under test was conducted in an explosive chamber with various concentrations of a methane-air medium. The basic electrical circuit of the experimental installation is presented and explained. During the experimental investigation the instantaneous power, the voltage at the arc, the current in each phase and the pressure of the explosion in the enclosure was recorded. A block diagram of the measuring system is presented and explained. A typical oscillogram of an arc short-circuit and the dependence of the power of an arc short-circuit on the input parameters are shown. The following data are presented in the form of tables: 1) The factors investigated and the limits of their variation; 2) Effect of environment in enclosure on electrical parameters of arc short circuit; and 3) Equations of regressive process of arc short circuit in closed volume. It is shown that the presence of a methane-air mixture in the enclosure does not exert a considerable influence on the amount of power of the arc short circuit because the thermal conduction of the mixture does not only increase the length of the arc, and consequently, also the voltage on it, but simultaneously the current of the arc short circuit is decreased. Figures 4; tables 3: references: 6 Russian.
[84-6415]

METHOD OF RESTORING INSULATION PARAMETERS OF TRANSFORMERS IN SERVICE

Moscow ENERGETIK in Russian No 7, Jul 81 pp 32-33

PIL'CH, M. L. and KENZHEGULOV, Zh. K., engineers

[Abstract] A technique for the restoration of insulation of oil-filled transformers while in service has been developed and implemented in the Southern Caucasus Power Equipment Repair Administration. The method has been applied to an ATDTN-30000/220 autotransformer which was installed in the winter of 1970. An attempt to restore the insulation during a major overhaul in 1978 by feeding DC through the windings and draining and drying the oil with centrifuges and adsorbents failed. The proposed method uses the adsorption properties of NaA

and NaX zeolites. Three thermosiphon filters on the autotransformer were removed for minor rebuilding and refilling and the zeolites were added in the amount of 0.2% of the oil weight. The amount of silica gel in each filter was the same as before. With the action of the load currents (temperature gradient), the moisture contained in the winding insulation goes into the oil and then with the natural circulation of the oil through the filter, the moisture is adsorbed by the zeolites. The insulation was restored after 6 months of operation with a load of 30 to 40% of nominal. The total transformer downtime for filter overhaul was 10 to 12 hours; the estimated cost of refilling and rebuilding was about 750 rubles. A tabular comparison of the restored parameters with the data sheet and measured values prior to repair shows a marked improvement in the absolute insulation resistance, the absorption coefficient and the capacitive characteristic. Figure 1.
[31-8225]

MONOLIT-5 INSULATION FOR HYDROELECTRIC POWER GENERATOR STATOR WINDINGS

Moscow ENERGETIK in Russian No 7, Jul 81 pp 31-32

MASOL'D, V. Ya., YAROSHENYA, Ye. I. and GORMAN, A. S., engineers

[Abstract] A technique of restoring the insulation of stator winding rods with mica tape compound insulation which have been removed for repair was developed by the All-Union Scientific Research Institute for Electrical Insulation Materials. The bituminous binder is removed first by means of heating it in a vacuum furnace; the insulation is then impregnated with an epoxy compound both in a vacuum and under pressure; an anticorrosion coating is applied and then the final finish work is done on the rod. The copper is completely used from the old insulation in this case without undoing the mica and the rod braiding. The result is a winding rod with what is called Monolit-5, a thermosetting mica epoxy insulation. The technical specifications for Monolit-5, Monolit-2 and compound mica tape insulation are summarized in tabular form. The improvement in the breakdown voltage of the insulation between the conductors before and after restoration is plotted as a function of the voltage; the test data show that Monolit-5 provides practically the same reliability and service life as completely rewinding a stator and using new thermosetting insulation. Test batches of rods with Monolit-5 have been in service since 1976. The insulation allows long term operation at 130°C, has better heat conductivity and because of the elimination of cavities in the insulation and slots, provides better heat transfer than mica tape compound insulation; this permits boosting generator power by 10 to 15% if necessary. The technology has been developed for SV2-1500/200-88 generators with a capacity of 123.5 MVA in service at the Volzhskaya GES imeni 22nd CPSU Congress. Figure 1.
[31-8225]

ELECTROMAGNETIC WAVE PROPAGATION, ELECTRODYNAMICS

UDC 537.8

SURFACE WAVES IN OPEN GUIDES WITH AZIMUTHAL GYROTROPY

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 26, No 7, Jul 81
(manuscript received 22 Apr 80) pp 1420-1424

PRUDKIY, V. P., GREBENYUK, S. V. and TERENT'YEV, Yu. M.

[Abstract] An analysis of azimuthally gyrotropic open waveguides by application of the perturbation theory to analogous isotropic waveguides is not accurate enough, because natural modes appear in them which completely vanish in an isotropic waveguide. An analysis must therefore begin with the Maxwell field equations, which are here formulated for a typical double-layer ferrite-dielectric circular waveguide. In the case of axial symmetry the corresponding boundary-value problem involves a system of linear differential equations. A numerical solution for an axisymmetric open waveguide consisting of an isotropic dielectric and an azimuthally magnetized ferrite reveals symmetric ($n=0$) and asymmetric ($n\neq 0$) H- and E- modes, also unidirectional surface waves and, when the dielectric permittivity of the dielectric is sufficiently high, a backward unidirectional surface wave. In the case of strong anisotropy the slowdown of these surface waves depends on the relative thickness of the ferrite ring $t=(R-r)/R$, plain and unidirectional surface waves appearing when the ring is thin ($t \leq 0.6$) but only one unidirectional surface wave appearing when the ring is thick($t > 0.6$). Figures 4; references 10: 9 Russian, 1 Western.
[34-2415]

UDC 551.46

SPECIFIC FEATURES OF MICROWAVE SCATTERING BY THE SEA AT SMALL GRAZING ANGLES

Gor'kiy IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOFIZIKA in Russian Vol 24, No 7, Jul 81 (manuscript received 21 May 80) pp 831-839

ZUYKOV, V. A., KULEMIN, G. P. and LUTSENKO, V. I., Institute of Radio Physics and Electronics, Ukrainian SSR Academy of Sciences

[Abstract] The specific back-scatter cross-section of a sea surface for small grazing angles varies as the fourth power of the grazing angle, with the exception of cases of increased refraction (e.g. in the 3-cm band) where it is found

experimentally to be directly proportional to this angle. This is due primarily to spray occurring with wave collapse, and is manifest especially at millimeter wavelengths. Back-scattering by a sea surface was measured at wavelengths of 3.2 cm, 8.15 mm and 4.1 mm for various polarizations with a pulsed radar using pulse widths of 0.2 and 0.4 microseconds and repetition rates of 2.5 and 5.0 KHz. The measurements were made near Sevastopol between 1977 and 1979. The radar set was placed on the shore 5.5 m above sea level and the presence of a considerable depth of 20 to 25 m at a distance of no more than 500 m from the shore allows for the extrapolation of the data to the open sea. The experimental findings are discussed and both a qualitative and quantitative accounting is made for the influence of the increased refraction in the atmospheric layer near the water and sea spray on the specific radar cross-section as a function of the grazing angle. Graphs of this function show a transition region, which is especially pronounced in the millimeter band, due to the spray and increased refraction. When the radar cross-section is plotted as a function of wind velocity, saturation is found to occur sooner in the millimeter band than in the centimeter band at low velocities. The theory permits the calculation of the overall effective back-scatter cross-section of the sea, taking into account spray scattering and the concentration of droplets in the air layer near the water. Figures 7; references 15: 10 Russian, 5 Western.
[33-8225]

UDC 621.371.332.4:535.36

DISPERSION INDICES AND ALBEDO OF VERY ROUGH SURFACES

Gor'kiy IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOFIZIKA in Russian Vol 24, No 7, Jul 81 (manuscript received 21 May 80) pp 840-850

KOPILOVICH, L. Ye. and FUKS, I. M., Institute of Radio Physics and Electronics, Ukrainian SSR Academy of Sciences

[Abstract] Traditional treatments of wave diffraction at statistically uneven surfaces using known approximation techniques do not take multiple reflections into account and always lead to nearly mirror type scattering indices which are greatly elongated in the direction of the mirror reflection from the mean surface. This paper proposes a mathematical model in order to compute the one-time scattering indices and albedo for even very rough surfaces with steep macroroughnesses, which explains the anomalies in the scattering index for such surfaces where the scattering maximum is not observed in the mirror reflection direction, but towards the source. The microstructure of a surface is mathematically defined for four specific types: 1) Mirror surface; 2) Frosted surface, such as used in solid-state physics to describe quasiparticle scattering; 3) Very rough surface with rough places higher than the wavelength; and 4) Slightly rough surface with small and gently sloping microroughnesses. The analysis of these statistically rough surfaces is used to plot theoretical graphs of the albedo and scattering indices as a function of the grazing angle; the agreement noted between the theory and computer

simulation is good in all cases. Even for surfaces with very steep roughnesses, the scattering indices and albedo are governed only by one-time reflection events. Multiple reflections increase with an increase in the grazing angle. No experimental data other than the computer simulations are cited in the theoretical treatment. Figures 7; references 4: 22 Russian, 2 Western.
[33-8225]

UDC 621.372.8:537.874.37

BEHAVIOR OF VLF SIGNAL PHASE DURING HOURS OF SUNRISE

Gor'kiy IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOFIZIKA in Russian Vol 24, No 7, Jul 81 (manuscript received 21 Jul 80) pp 794-798

POPOV, A. V. and YAMPOL'SKIY, Yu. M., Institute of Terrestrial Magnetism, Ionosphere and Radio Wave Propagation, USSR Academy of Sciences

[Abstract] The "adiabatic" irregular waveguide theory of VLF propagation is contradicted by experimental data showing that VLF phase variations during sunrise at the receiver are nonmonotonic, although the height of the waveguide varies monotonically. The contradiction can be resolved through the incorporation of a pair of correcting factors which take into account the curvature of the phase front of a normal wave, due to the inclination of the waveguide walls; these corrections produce a nonmonotonic phase curve. An analytical expression is derived for the observed phase checked experimentally against data from observations at the GBR and NAA stations at 16 KHz and 17.8 KHz in Rugby, England and Halifax, N.S., respectively, with the receiver near Khar'kov. All of the measurements data from 1974 and best agreement between experiment and theory was found in the single mode case with the following parameters: the scale of the longitudinal waveguide inhomogeneity was 300 km and values of a = 75 km and b = 15 km, where the characteristic width h at night is a + b and during the day, $h_{day} = a - b$. The VLF phase variations are qualitatively explained, and while the derived equations make it theoretically possible to determine the "night-day" inhomogeneity parameters in the earth-ionosphere waveguide, they nonetheless contain an unknown constant a, and one of the constants h_{day} or h_{night} must be determined independently. The authors thank P. V. Blikhokha and V. A. Borovikova, who initiated the work. Figures 3; references: 8 Russian.
[33-8225]

GENERAL TREATMENT, INCLUDING POLICY DECLARATIONS, OVERALL STATISTICS, FORECAST OF TRENDS, 'THINK PIECES'

UDC 621.36:621.3.001.1

ELECTRICAL TECHNOLOGY IN MANUFACTURE OF ELECTRICAL PRODUCTS ABROAD

Moscow ELEKTROTEKHNIKA in Russian No 7, Jul 81 pp 56-59

LYAKHOVICH, A. P., candidate of technical sciences

[Abstract] A survey is made of electrical technological processes used for materials and parts processing in countries outside the Soviet Union. These processes are classified here on the basis of the form of energy utilized: heat (electrothermal smelting and welding, electroerosion), electrochemical energy (electrophoresis, galvanization, electrolysis), electromagnetic energy, electrostatic energy, and mechanical energy (vibration and friction). Particularly interesting are high-temperature and low-temperature techniques developed by the SIGRI Co. (Federal Republic of Germany), the ASEA Co. (Sweden), and the Masser Co. (Belgium), laser techniques of surface treatment developed by the Siemens Co. (Federal Republic of Germany) and the Plasma Technik Co. (Switzerland), ultraviolet techniques of printed-circuit processing used in Western countries and Japan, electron-beam techniques developed by the IKPE Institute (Romania), the E. Haefely Co. (Switzerland), the Radiation Dynamics Co. (United States), and the Electricity Council (United Kingdom), and electrostatic techniques developed by the Bill Switchgear Co. (United Kingdom), the Westinghouse Co. and the General Electric Co. (United States). Figures 1.
[29-2415]

INSTRUMENTS, MEASURING DEVICES AND TESTERS, METHODS OF MEASURING, GENERAL EXPERIMENTAL TECHNIQUES

UDC 53.088.3

INCREASE OF MEASUREMENT ACCURACY WITH ITERATION ERROR CORRECTION

Moscow IZMERITEL'NAYA TEKHNIKA in Russian No 4, Apr 81 pp 12-14

ALIYEV, T. M., DAMIROV, D. I. and SHEKIKHANOV, A. M.

[Abstract] Iteration automatic error correction is an effective means which assures high accuracy of digital measurement of analog magnitudes. The attainable accuracy during this is determined by the accuracy of a set of reference standards for the magnitude being measured. One of the other reference standard nearest to the value of the magnitude being measured is assigned with the aid of a determined digital code obtained after special processing of the results of analog-digital conversion of the input and sample magnitudes. Consequently, as a set of reference standards, a digital-converter (TsAP) is used here. One of the principles which make iteration correction especially effective is the fact that the creation of high-precision TsAP does not encounter difficulties at present. In spite of this, the maximally attainable precision of measurements by the iteration method is, nevertheless limited by the accuracy of the TsAP and consequently a particular urgency is acquired by methods and procedures which make it possible to reduce the requirements on its precision. An iteration algorithm is derived, and a block diagram of a measuring device which realizes the generalized iteration algorithm is presented. A procedure is proposed, not inferior to the classical iteration correction, which ensures obtaining accurate results with the existence of errors of both the amplitude-digital and the digital-amplitude converters being corrected. The maximum attainable accuracy in this case is limited only by the accuracy of the source of samples of analog magnitudes. Figures 2; references: 2 Russian.
[26-6415]

UDC 532.57:537.871.7

SPECTRAL ANALYSIS OF SIGNAL FROM LASER-TYPE DOPPLER ANEMOMETER FOR MEASURING FLOW WITH VELOCITY GRADIENT

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 26, No 7, Jul 81
(manuscript received 28 May 79, after revision 12 Jun 80) pp 1564-1573

KASHCHEYEVA, G. A. and SOBOLEV, V. S.

[Abstract] The energy spectrum of a signal from a laser-type Doppler anemometer is analyzed, such an instrument being particularly suitable for flow measurements where a velocity gradient exists. With shot noise in the photoreceiver negligible within a narrow frequency band, the Doppler signal can be represented as a random flux of radio pulses describable by their amplitude, envelope, and frequency. This signal is found to be a stationary random process and its statistical characteristics are established accordingly. Its energy spectrum is determined only by the sum of the "autocorrelation" components of each radio pulse. The velocity profile can be retrieved from this spectrum, ideally when the instrumental broadening is infinitesimally small, as demonstrated in the case of a laminar flow and a flow with a constant velocity gradient. In practice, however, the instrumental broadening must be accounted for and its magnitude relative to the velocity drop estimated. Figures 4; references: 4 Russian.
[34-2415]

UDC 534.6.08:621.317.743.5

MEASUREMENT OF SENSITIVITY OF ACOUSTICAL RECEIVERS IN ANECHOIC CHAMBERS

Moscow IZMERITEL'NAYA TEKHNIKA in Russian No 4, Apr 81 pp 47-49

BARON, S. B.

[Abstract] Requirements are formulated for the ratio of the dimensions and directivity of the radiator of test and master acoustic devices and the fidelity of substitution. The basis is given for the choice of the method of measurement in an anechoic chamber with the use of a continuous tonal signal as a function of the test levels, the frequency range, the characteristics of the measuring means, and the labor intensity. A rule is established, which, with specified ratios of the dimensions and configuration of the radiator of the experimental and calculating devices, the operating frequency band and the precision of the coordinate device, optimizes the choice of the method of measurement and the number of observations which assure the minimum labor intensity. Figures 1; references: 2 Russian.
[26-6415]

UDC 535.34:539.22

ABSORPTION COEFFICIENT OF RADIATION PROPAGATION IN NONUNIFORM MEDIUM

Moscow IZMERITEL'NAYA TEKHNIKA in Russian No 4, Apr 81 pp 29-30

ARKHIPOV, M. F. and REZNIK, A. M.

[Abstract] The method of measuring the characteristics of a medium by passing some sort of radiation through it is widely used in practice. Attenuation of the radiation flow = J. If for such measurements a radiation flow is used, which propagates along one axis X, then assuming uniformity of the medium, the magnitude of attenuation of the radiation flow is determined with the aid of the equation

$$J = J_0 \exp(-\alpha, \Delta_x).$$

In real conditions, an assumption that the material is uniform is frequently a rough approximation. Variations of the volumetric properties of a material leads to the fact that an evaluation of the importance of the attenuation factor α with the assistance of the equation above with respect to the results of an experiment proves to be an understatement. Further, it is shown that if the statistical characteristics of nonuniform material are known, then it is possible to supplement the above equation by a correction factor, taking into account the nature of the nonuniformity. Another equation is derived from which it is seen that in material which is not uniform the radiation flow is absorbed less at the value of the factor $\mathrm{ch}(\bar{\alpha})\varphi$ as compared with uniform material (equation above). References: 4 Russian.
[26-6415]

UDC 539.123.089.6

MAXIMUM ERROR OF REPRODUCTION AND TRANSFER OF UNITS OF ABSORBED DOSE OF NEUTRON RADIATION

Moscow IZMERITEL'NAYA TEKHNIKA in Russian No 4, Apr 81 pp 50-51

MARCHENKO, A. V. and MASLYAYEV, P. F.

[Abstract] Methods of evaluating the variance distribution of absorbed energy are considered. Although these methods are valid for various magnitudes and are utilized for different conditions of irradiation, attention is given in the present paper to particular cases of calculation and measurement of the absorbed energy of neutron radiation. The calculated relations are presented in Figure 1 of the relative root-mean-square deviation of the results of observation of $\delta(E_{t,m})$ of the absorbed energy in an object of tissue-equivalent substance with energies 0.1; 0.5; 1; 2; 10 MeV. The calculated values are shown in Figure 2 of the minimum necessary averaging time T as a function of the permissible value of the error δ with an average power of the dose of 10^{-9} Gr/c for neutrons of the same energy as that in Figure 1, and a chamber with a 1 g mass of gas. Figures 2; references: 3 Russian.
[26-6415]

UDC 621.313.13.01-251

METHOD OF MEASURING FLUCTUATIONS OF ELECTRIC MOTORS' ANGULAR SPEED

Moscow IZMERITEL'NAYA TEKHNIKA in Russian No 4, Apr 81 pp 35-38

INOZEMTSEV, I. M. and IVANOV, O. A.

[Abstract] The paper considers the special features of measuring the statistical parameters (chiefly the spectral density) of the fluctuations of the angle of rotation of the rotor, for low-power electric motors which are involved with a system of automatic control. A figure shows the experimental dependences of the phase fluctuations on the time $\varphi(t)$ of a signal from a transducer mounted on the shaft of a Type G-234 electric motor. In the simplest case it is possible to measure the nonuniformity of fluctuations of the angle of rotation of the rotor of an electric motor on a test stand, a block diagram of which is presented and explained. Use of a measuring circuit with two identical motors, one of which includes a system of automatic control, has a great potentiality. A block diagram of this measuring unit is also presented and explained. It should be noted that an increase of the load on the axis of the body decreases the amplitude of the fluctuations of the angle of rotation at frequencies of 4-7 Hz which corresponds to the frequency of "wobble" of the rotor. However, it does not [illegible] away with fluctuations at higher frequencies and even leads to their increase. Thus measurement of the spectral characteristics of the fluctuations of the phase of the signal by the transducer mounted on the shaft of an electric motor facilitates an analysis of the principles which cause instability of the angular speed of the electric motor. Figures 3.
[26-6415]

UDC 621.317.36.089.6:519.2

ERRORS OF FREQUENCY MEASUREMENT USING PRINCIPLE OF PULSE GENERATION

Moscow IZMERITEL'NAYA TEKHNIKA in Russian No 4, Apr 81 pp 42-44

TYRSA, V. Ye. and DYUNYASHEV, V. V.

[Abstract] A mathematical description of a method for measuring frequency using the principle of pulse coincidence of regular independent sequences is presented in a 1975 paper by V. Ye. Tyrsa (see above). On its basis a number of digital frequency meters were synthesized. The present work analyzes the following types of error found in these meters: 1) Error from quantization; 2) Error because of instability of reference frequency; 3) Error because of instability of threshold of former, and nature of input signal; and 4) Error because of interference at input. Use of the expressions obtained for the errors of digital photometers during development of a digital frequency meter lead to a reduction of the errors of the method inherent in series production frequency meters by 2-3 orders. Figures 1; tables 1; references: 10 Russian.
[26-6415]

UDC 621.383.52

PHOTOCONDUCTANCE OF LONG DIODES DURING LIGHT ABSORPTION BY INJECTED CHARGE CARRIERS AND THEIR HEATING BY ELECTRIC FIELD

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 26, No 7, Jul 81
(manuscript received 2 Apr 80) pp 1574-1580

BLOKHIN, I. K., OSIPOV, V. V., STAFEYEV, V. I. and KHOLODNOV, V. A.

[Abstract] The photoconductance of long p-i-n diodes during light absorption by charge carriers in an electric field is calculated, taking into account a weak dependence of the carrier lifetime and mobility on the electric field intensity. The analysis is based on the generation-recombination equation for the time rate of change of carrier concentration in a deeply doped semiconductor. Corrections are made for the heating of charge carriers by both the incident light and the electric field, the smallness of this warmup making a linear approximation permissible. The dependence of the effective temperature on the electric field intensity and on the luminous flux density is determined from the equation of energy balance through application of the perturbation method, with the electrophysical properties of the semiconductor with a single carrier scattering mechanism described as power functions of the temperature. The warmup is found to cause a vertical rise of the current-voltage characteristic within its range of negative differential resistance, accompanied by injectional amplification. The maximum gain due to this amplification in a compensated semiconductor, in the case of carrier scattering by acoustic phonons and a temperature-independent cross section for electron capture, can reach several orders of magnitude. References 18: 12 Russian, 6 Western (three in translation).
[34-2415]

UDC 681.78:006.354.065

DETERMINATION OF SPECTRAL CHARACTERISTICS OF NONLINEAR PHOTODIODES

Moscow IZMERITEL'NAYA TEKHNIKA in Russian No 4, Apr 81 pp 27-28

BORISOV, V. A., DOLGANIN, Yu. N. and KUCHERENKO, I. A.

[Abstract] In the present work a comparative evaluation is made of methods for measuring the spectral characteristics and sensitivity of nonlinear photodetectors. It is shown that the equisignal method of measuring makes it possible to eliminate errors caused by the nonlinear energy characteristics of the photodetector. The spectral response of a nonlinear detector found by the equisignal method, as well as its energy characteristics, make it possible to determine the reaction of a photodetector to radiation of a given spectral composition and a given power. Figures 3; references: 8 Russian.
[26-6415]

POWER SYSTEMS (INCLUDING EFFECT OF VARIOUS ITEMS ON POWER TRANSMISSION)

UDC 621.315.1

HIGH-CAPACITY OVERHEAD ELECTRICAL TRANSMISSION LINES

Moscow ELEKTRICHESTVO in Russian No 7, Jul 81 (manuscript received 25 Nov 80) pp 1-6

ALEKSANDROV, G. N., doctor of technical sciences, Leningrad Polytechnic Institute

[Abstract] The performance of overhead a.c. transmission lines is analyzed on the basis of an efficient power transfer at an economical current density without exceeding the corona-limited electric field intensity at the conductor surfaces. The normal power flow per strand, contrary to traditional concepts, is found f not to depend on the number of strands per phase and the charge on a conductor to increase less than proportionally with increasing number of strands. Accordingly, several variants of conductor splitting are considered with either a closer spacing of strands or an enlarged bundle radius: coaxial, bicoaxial, parabolic, straight vertical and straight horizontal. With the conventional limitation removed, it appears to be feasible to thus raise the power capacity of an overhead a.c. transmission line by much more than 50% previously regarded as being unsurpassable. Since no functional relation exists between the power capacity of a transmission line and the nominal voltage, each design must be evaluated separately for a given voltage class. Figures 6; tables 1; references 8: 6 Russian, 2 Western.
[30-2415]

PRODUCTION TECHNOLOGY

UDC 621.36:533.5.001.4

ELECTROTHERMAL EQUIPMENT FOR VACUUM COATING

Moscow ELEKTROTEKHNIKA in Russian No 7, Jul 81 (manuscript received 9 Feb 81) pp 37-40

VERETIN, M. I., YEMEL'YANOV, A. L., YEMEL'YANOV, V. L., ZHUNDA, A. N., engineers, and YADIN, E. V., candidate of technical sciences

[Abstract] Development of a new technology and equipment for producing metal coatings by the vacuum evaporation process contributes greatly to a more economical high-volume production, especially in the electrical industry. Use of aluminum as contact material, for instance, eliminates the need for nickel and reduces the consumption of silver. The choice of a particular evaporation and condensation technique depends on the application, on the base material and the coating material. Two variants of vacuum evaporation equipment have been developed and built at the Special Design Office in Riga. The model UV-73 for unilateral cadmium coating of nickel tape or bilateral cadmium coating of perforated nickel tape consists of a working chamber with an electric-arc evaporator and cooling drums, also a tape winder which keeps the tape moving continuously under the spray gun. The model UV-77 for bilateral aluminum coating of capacitor paper consists of a working chamber with a resistive evaporator, a wire feed mechanism, a gate, mechanical masks, cooling drums and a baffle. The coating thickness in both can be controlled by the winding speed at a tension which is held constant. At the Khar'kov branch of the All-Union Scientific-Research Institute of Electrothermal Equipment there has been developed and built an experimental-industrial model EPP-40-2I1 electron-beam machine for aluminum coating of silicon devices. It consists of a vacuum chamber with a turntable carrying a set of crucibles, two diametrally spaced high-voltage electron-gun evaporators, an electric heater for warming up the substrate, and a baffle. Here the coating thickness is controlled by the number of passes of the turntable over the evaporators. Figures 5; tables 3; references: 2 Russian.
[29-2415]

UDC 621.313:791.3.001.4

ELECTROMAGNETIC INSTALLATIONS FOR AUTOMATIZED SOLDERING OF PRINTED CIRCUIT BOARDS AND UNITS

Moscow ELEKTROTEKHNIKA in Russian No 8, Aug 81 (manuscript received 9 Feb 81) pp 36-38

GEL'FGAT, Yu. M., candidate of technical sciences, IUKKANEN, G. Ya., engineer and MIKEL'SON, A. E., doctor of technical sciences

[Abstract] The transfer to printed circuitry by an increasing number of subassemblies and products of radioelectronic and instrument building is determined to a fairly large extent by the opening up of the possibilities of automation of one of the most labor-intensive assembly operations -- soldering. Consequently, the problem of creating a highly productive equipment for automatized group soldering is extremely urgent and requires simultaneous consideration of both a specific technological process and the special features of the design of soldering assemblies. These requirements are well satisfied by the electromagnetic equipment for automated soldering jets or by waves of molten solder -- magnetohydrodynamic wave oscillators (MHWO) -- which were developed at the Institute of Physics of the LaSSR Academy of Sciences and its Special Design Bureau of Magnetohydrodynamics, jointly with PO VEF (Production Association Riga Order of Lenin State Electrical Engineering Plant imeni V. I. Lenin = Valsts elektrotechniska fabrike [VEF]) and PO "Radiotekhnika" (Production Association Radio Engineering), Riga. MHWO have a number of advantages in comparison with customarily used mechanical drives for creating movement of liquid solder: the possibility of obtaining hydraulic thrust of liquid metal without any contact with the foreign components moving in it; the small power consumption and the high effectiveness of operation; the possibility of simple control of the parameters of the manufacturing process; the small dimensions and metal content. In addition, MHWO are simply installed in assembly conveyers or used in separate small automated lines for soldering in conjunction with installations for fluxing, drying, washing, etc. The work of all MHWO is based on the use of an electromagnetic pump of some type combined with a bath of melted solder. Drawings are shown of three types of MHWO and their principal characteristics and methods of operation are given. Figures 4; tables 2; references: 8 Russian.
[84-6415]

UDC 621.373.826:53.072.13

METHOD OF EQUIVALENT ELECTRIC MODELS IN THEORY OF INTERNAL LASER MODULATION

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 26, No 7, Jul 81
(manuscript received 13 Dec 79) pp 1461-1468

POLYAKOV, G. I.

[Abstract] The equivalent electric circuit diagram for a single-mode laser is extended to a multimode laser with internal modulation. In the case of synchronous frequency modulation the strongest mode becomes the carrier and together with its side modes forms a supermode. Several supermodes can exist simultaneously, at the edge of the synchronization band and only when the frequency separation between modes is much larger than the modulation frequency. Here the relations which characterize mode locking are derived on the basis of this equivalent electric circuit, assuming that in the steady state such a laser operates with one supermode only. In the case of amplitude modulation converting from difference to differential equation yields the description of a harmonic oscillator. In the case of asynchronous frequency modulation signals are distorted because of the finite velocity of the electromagnetic field in the resonator cavity and because of the nonlinear dependence of the frequency of generated oscillations on the resonator reactances. Figures 2; references 13: 3 Russian, 1 Rumanian, 9 Western (one in translation).
[34-2415]

UDC 621.373.826

EMISSION RANGE OF GAS LASERS WITH NONHOMOGENEOUS ACTIVE MEDIUM

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 26, No 7, Jul 81
(manuscript received 14 Sep 78, after revision 19 Sep 80) pp 1453-1460

AKCHURIN, G. G., MEL'NIKOV, L. A., RABINOVICH, E. M. and TUCHIN, V. V.

[Abstract] Theoretical and experimental studies are continued pertaining to the emission range of gas lasers with a nonhomogeneous active medium and a uniformly widening emission line. Fundamental relations are established for such a laser with a 2-mirror resonator cavity formed by a totally reflecting spherical mirror

and a partially transmitting plane mirror with a lenticular medium filling the space between them. The emission intensity is calculated as a function of the excess gain and as a function of the frequency deviation. Saturation of the active medium with the radiation field is found to produce hysteresis effects in the frequency dependence. Transients after turn-on and turn-off are calculated from the equation of emission balance, which yields the rate of change of emission intensity during the period of a wave circulation in the resonator and which has been solved by the Euler method. From this equation can also be calculated the intensity jumps at the emission threshold. Experimental data obtained for a CO_2-laser supplement those obtained earlier for a He-Ne laser. Figures 4; references 8: 4 Russian, 4 Western.
[34-2415]

SEMICONDUCTORS AND DIELECTRICS, CRYSTALS IN GENERAL

UDC 621.315.592

PIEZO-OPTICAL STUDY OF DISLOCATIONAL ELECTRON STATES IN CADMIUM SULFIDE

Leningrad FIZIKA I TEKHNIKA POLUPROVODNIKOV in Russian Vol 15, No 8, Aug 81
(manuscript received 22 Jul 80) pp 1467-1472

SAL'KOV, Ye. A., TARBAYEV, N. I. and SHEPEL'SKIY, G. A., Institute of Semiconductors, UkSSR Academy of Sciences

[Abstract] An experimental study of CdS single crystals was made to determine the effect of uniaxial elastic strain on their photoluminescence and optical absorption spectra as well as the symmetry of their dislocational electron states resulting from plastic deformation. Specimens in the shape of rectangular parallelepipeds with plane-parallel faces in various crystallographic planes were cut from undoped crystals grown from the gaseous phase, then ground and mechanically polished as well as chemically etched and polished. These specimens were placed in a cryostat with liquid helium (4.2 K) or liquid nitrogen (77 K) and subjected to uniaxial compression. With the polarized light beam always perpendicular to the compression axis, the spectra were recorded with an ISP-51 instrument giving a linear dispersion of 5 nm/mm. Uniaxial compression along the crystallographic C-axis ($P \parallel [0001]$) was found not to lower the symmetry group and cause no splitting of spectral lines. Uniaxial compression across the crystallographic C-axis ($P \parallel [1\bar{1}00]$ or $P \parallel [11\bar{2}0]$) was found to lower the symmetry group from C_{3v} to C_{2v} and cause each dislocation band in the emission spectrum to split reversibly into two components. In the absorption band here only splitting of the first line into two components could be ascertained, the other lines possibly splitting into more components or not splitting at all. With uniaxial compression in the direction $P \parallel [1\frac{1}{4}\frac{3}{4}0]$, the first line in the absorption spectrum had split into three components. With uniaxial compression in the direction $P \parallel [1\frac{1}{4}\frac{3}{4}1]$, each of the three components had split further into two. Figures 5; tables 1, references 6: 5 Russian, 1 Western.
[27-2415]

UDC 621.315.592

ELECTRON-ELECTRON INTERACTION IN SAMARIUM SULFIDE AND INTERPRETATION OF ITS OPTICAL SPECTRA

Leningrad FIZIKA I TEKHNIKA POLUPROVODNIKOV in Russian Vol 15, No 8, Aug 81 (manuscript received 29 Jul 80) pp 1473-1478

FARBEROVICH, O. V., Voronezh State University imeni Leninskiy Komsomol

[Abstract] The one-electron band spectrum of SmS, namely its metal and semiconductor phases, was calculated by the method of attached plane waves. The calculation was based on the centrisymmetric part of the multipole expansion only, with the electron-electron Coulomb interaction averaged over the angles, resulting in a shift but not a split of terms. A comparison with experimentally obtained optical absorption spectra indicates that this method of calculating the excited states with the one-electron band as the zeroth approximation yields accurate results in the case of samarium monosulfide with a highly localized 4f-band in the fd-configuration. Figures 2; references 25: 14 Russian, 11 Western (two in translation).
[27-2415]

UDC 621.315.592

QUASI-ENERGY SPECTRUM OF SEMICONDUCTORS WITH EXTREMELY NARROW FORBIDDEN BAND IN LASER RADIATION FIELD

Leningrad FIZIKA I TEKHNIKA POLUPROVODNIKOV in Russian Vol 15, No 8, Aug 81 (manuscript received 3 Nov 80) pp 1493-1497

AVETISYAN, S. K., KAZARYAN, E. M., MELIKYAN, A. O. and MINASYAN, G. R., Yerevan Polytechnic Institute imeni Karl Marx

[Abstract] The quasi-energy spectrum of a 2-band semiconductor with an extremely narrow forbidden band ($E_g \sim 10^{-2}$ eV) in the field of a highly monochromatic light wave is calculated exactly, with all transitions between the two bands and also intraband effects correctly accounted for. The resonance approximation is not applicable here, inasmuch as the interaction parameters in this problem can approach unity. Instead, the Hill method is used starting with the interaction Hamiltonian and, considering the existence of a continuous spectrum. An expression for the quasi-energy is obtained from the solution to the Schroedinger wave equation. A numerical calculation of the spectrum requires an evaluation of the residue function, which can be done only through expansion into a power series. The results are illustrated by two examples: $\hbar\Omega = 2E_g$ and $\hbar\Omega = 1.5E_g$ (Ω = frequency of the light wave). The authors thank V. G. Grigoryan for a helpful discussion of the results obtained. Figures 1; references 5: 4 Russian, 1 Western (in translation).
[27-2415]

UDC 621.315.592

ELECTRICAL CONDUCTIVITY OF GLASSY CHALCOGENIDE SEMICONDUCTORS IN HIGH-INTENSITY ELECTRIC FIELDS

Leningrad FIZIKA I TEKHNIKA POLUPROVODNIKOV in Russian Vol 15, No 8, Aug 81 (manuscript received 18 Nov 80) pp 1511-1518

LEBEDEV, E. A. and ROGACHEV, N. A., Physico-Technical Institute imeni A. F. Ioffe, USSR Academy of Sciences, Leningrad

[Abstract] The electrical conductivity of two glassy semiconductors, $3As_2Se_3.As_2Te_3$ and $Tl_2Se.As_2Te_3$, was measured by the pulse method. Single rectangular pulses of 10-3000 V amplitude and $5\cdot10^{-7}$-10^{-1} s duration were applied to a test circuit consisting of a specimen and a load resistance. The field dependence of the electrical conductivity σ was found to follow the exponential relation $\sigma = \sigma_0 e^{E/E_0}$ in strong electric fields of the order of $E = 10^5$ V/cm, with E_0 not depending on the specimen thickness but on the temperature according to the relation $E_0^{-1} = A(T^{-1}-T_0^{-1})$ and the parameters A, T_0 depending on the material. The departure from Ohm's law, at approximately $E = kT/er_0$ (r_0 - shielding radius) is attributable to additional ionization of localized states by the Frenkel'-Pool mechanism with a correction also accounting for the wide energy spectrum of localized states within the forbidden band of these two compounds. The authors thank B. T. Kolomiyts for continuous interest, as well as B. I. Shklovskiy and A. L. Efros for helpful discussions. Figures 4; references 20: 12 Russian, 8 Western.
[27-2415]

UDC 621.315.592

SHIELDING OF ELECTRIC FIELD IN MULTILAYER SEMICONDUCTOR

Leningrad FIZIKA I TEKHNIKA POLUPROVODNIKOV in Russian Vol 15, No 8, Aug 81 (manuscript received 20 Nov 80) pp 1523-1527

SYSOYEV, B. I., BEZRYADIN, N. N. and SYNOROV, V. F., Voronezh State University imeni Leninskiy Komsomol

[Abstract] The shielding of the electric field in multilayer systems such as $MS_1S_2S_3M$ and $MS_1S_2S_3DM$ (M - metal layer, S - semiconductor layer, D - dielectric layer) with interlayer potential barriers is analyzed theoretically in a one-dimensional approximation and with the following assumptions: all the S layers are of the n-type and have the same thickness, the MS contact potential differences are zero, the dielectric layer is ideal, identical boundary state of the acceptor type exists at the boundaries between S layers. The profiles of the electric potential and the electric field intensity are found by numerical integration of the Poisson equation for the semiconductor layers and collocation at the boundaries with field intensity jumps taken into account. The charge density in

the boundary state is assumed to be

$$\sigma(\varphi_{jd}) = \frac{qN_{ts}}{1+g\exp\frac{(E_{ts}-E_{FO})-q\varphi_{jd}}{kT}}$$

(φ_{jd} - boundary potential, N_{ts} and E_{ts} - concentration and embedment depth of discrete boundary center, E_{FO} - location of the Fermi level in S_1 with "plane" bands). Numerical results are shown for various electron concentrations with the same layer thickness and for various layer thicknesses with the same electron concentration in the triple-layer semiconductor sandwiches. Figures 2; references: 10 Russian.
[27-2415]

UDC 621.315.592

EFFECT OF THERMAL ANNEALING AND OF COOLING CONDITIONS ON ELECTROPHYSICAL PROPERTIES OF N-TYPE SILICON WITH PHOSPHORUS IMPURITY

Leningrad FIZIKA I TEKHNIKA POLUPROVODNIKOV in Russian Vol 15, No 8, Aug 81
(manuscript received 25 Nov 80) pp 1531-1534

BARANSKIY, P. I., SAVYAK, V. V. and SHAPOVALOV, V. P., Institute of Semiconductors, UkSSR Academy of Sciences, Kiev

[Abstract] An experimental study was made to determine the effect of thermal annealing with subsequent cooling at various rates on the electrophysical properties of n-type silicon crystals heavily doped with phosphorus (10^{16} cm^{-3}). Specimens of such n-Si<P> crystals were grown in the <001> direction by the Czochralski method. The electron concentration, the electron mobility, and the electrical resistivity were measured at 300 K and at 77 K before and after high-temperature annealing at 1200°C for 2 h with subsequent cooling at 4 different rates (1000, 30, 15, 1 °C/min) as well as before and after low-temperature annealing at 500°C for 2 h with subsequent cooling at the same 4 different rates. Generally all these characteristics had not been significantly affected by any heat treatment, only the electron mobility at 77 K had been decreased rather than increased by slow cooling. While the piezoresistance as a function of the mechanical stress had not changed by any heat treatment, the piezothermal emf in the saturation range had been decreased by each heat treatment, but in each case by an amount becoming smaller with decreasing cooling rate. The degree of anisotropy of the thermal emf was found to decrease linearly with increasing cooling rate, except for a slight peak within the 10-15 °C/min range. This peak is attributed to defects forming at these cooling rates only and rather "uniquely" interacting with long-wave phonons. Figures 2; references: 4 Russian, 1 Western in translation.
[27-2415]

UDC 621.315.59

SELF-EXCITED OSCILLATIONS IN SEMICONDUCTORS UNDER CONDITIONS OF IMPURITY BREAKDOWN

Leningrad FIZIKA I TEKHNIKA POLUPROVODNIKOV in Russian Vol 15, No 8, Aug 81 (manuscript received 28 Nov 80) pp 1542-1545

VLADIMIROV, V. V., GORSHKOV, V. N. and GOLOVINSKIY, P. M., Institute of Physics, UkSSR Academy of Sciences, Kiev

[Abstract] Sel-excitation of oscillations in a unipolar silicon plasma at the liquid-neon temperature (27 K), following breakdown of "frozen" donor impurity centers by an electric field, is analyzed on the basis of the continuity equation for electrons, the current equation, and the equation of delay in impact ionization. Extremal values of ionization and recombination parameters are used for the calculations. With the electric field in the direction of a $\langle 100\rangle$ axis, there appears a negative differential mobility of medium-velocity electrons at electric field intensities within the 30-60 V/cm range and self-excited oscillations will occur with a frequency of $4\cdot 10^7$-$3\cdot 10^{10}$ Hz depending on the donor concentration. With the electric field in the direction of a $\langle 111\rangle$ axis, a negative dynamic differential conductivity appears and self-excited oscillation will occur with frequencies higher than 10^{10} Hz. Results are shown which have been obtained by numerical integration of the three basic equations, with typical data on the equilibrium electron concentration and the impact ionization, also taking into account saturation of the electron drift velocity with an increasing electric field intensity to $v = 10^7$ cm/s at $E \geq 10^4$ V/cm. Large oscillations with amplitudes up to 10 kV/cm are found to occur at some optimum donor center concentration at about 10^{16} cm^{-3}. Increasing the coefficient of impact ionization (E = 1900 V/cm) or the delay of impact ionization ($\tau = 5\cdot 10^{-11}$ s) will lower the optimum donor center concentration. The authors thank O. G. Sarbey for helpful discussion. Figures 4; references 9: 5 Russian, 4 Western.
[27-2415]

UDC 621.315.592

ENTRAPMENT OF POSITRONS BY RADIATIVE POINT DEFECTS IN GERMIUM

Leningrad FIZIKA I TEKHNIKA POLUPROVODNIKOV in Russian Vol 15, No 8, Aug 81 (manuscript received 9 Dec 80) pp 1550-1556

ARIFOV, P. U., ARUTYUNOV, N. Yu. and YEMTSEV, V. V., Physico-Technical Institute imeni A. F. Ioffe, USSR Academy of Sciences, Leningrad

[Abstract] An experimental study was made in order to determine the effect of point defects in germanium produced by gamma-radiation on the angular distribution of annihilation gamma-quanta in irradiated germanium. Single crystals of n-type germanium were grown for this purpose by the Czochralski method and doped with group-V impurity elements (As, Sb, Bi) to $7\cdot 10^{14}$-10^{16} cm^{-3} concentrations.

The concentration of oxygen and carbon did not exceed $5 \cdot 10^{15}$ and 10^{16} cm^{-3} respectively. The specimens were irradiated with a dose of $5 \cdot 10^{12}$ quanta/$(cm^2 \cdot s)$ from a Co^{60} source at room temperature and with fast neutrons from the LINPh (Leningrad Institute of Nuclear Physics, USSR Academy of Sciences) reactor at a temperature not higher than 80°C. A point-line geometry was realized and a Na^{22} specimen with an activity level of 15 mCi served as the source of positrons. Measurements were made with an instrument giving an angle resolution of 1 milliradian. An examination of the recorded angular distributions in various crystallographic directions in the initial material and in the residual material reveals changes including an anisotropy, but no consistent theory of positron entrapment and annihilation by local centers is yet available for a complete description of the defect pattern. It appears so far that the angular distribution of annihilation gamma-quanta is anisotropic when the wave function of an electron localized deep in the momentum space is, but not in the same manner as in the case of annihilation by valence electrons. The difference could be due to distortion by the positron wave function. The authors thank M. I. Klinger and A. Seeger for the discussion and critical comments, also V. Yu. Trashchakov and E. E. Rubinov for the assistance in performing the experiments. Figures 3; tables 1; references 25: 10 Russian, 15 Western.
[27-2415]

UDC 621.315.592

DETERMINATION OF PARAMETERS OF DEEP LEVELS IN EPITAXIAL GaP:ZnO LAYERS WITH AID OF TWIN SURFACE-BARRIER DIODES

Leningrad FIZIKA I TEKHNIKA POLUPROVODNIKOV in Russian Vol 15, No 8, Aug 81 (manuscript received 28 Oct 80, after final editing 19 Feb 81) pp 1660-1662

BULYARSKIY, S. V., ZHELYAPOV, G. I., NAGRADOVA, I. A., NEVSKIY, O. B. and CHICHULIN, A. V., Kishinev Polytechnic Institute imeni S. Lazo

[Abstract] The feasibility of using twin surface-barrier diodes for nondestructive determination of the parameters of recombination levels in apitaxial layers was examined experimentally on GaP layers doped with ZnO and deposited on an n-type substrate. Schottky diodes were produced by chemical deposition of gold contacts. Here the energy diagram and the current-voltage characteristic of such diodes are analyzed theoretically, with the Richardson equation for the saturation current and the equation for the decrease of height of a potential barrier. With the entire applied voltage dropping across the reverse-biased junction, the temperature dependence of the thermal hole-emission rate and the concentration of recombination levels can be calculated from readings taken with a forward-biased function cooled to the given temperature. The resultant diode capacity and its transient change during voltage polarity reversal is taken into account. Figures 2; references 10: 5 Russian, 5 Western.
[27-2415]

UDC 621.315.592

INERTIAL CHARACTERISTICS OF HOT ELECTRONS IN N-TYPE GALLIUM ARSENIDE

Leningrad FIZIKA I TEKHNIKA POLUPROVODNIKOV in Russian Vol 15, No 8, Aug 81 (manuscript received 9 Dec 80) pp 1564-1567

RAGUOTIS, R. and REKLAYTIS, A., Institute of Semiconductor Physics, LiSSR Academy of Sciences, Vilnius

[Abstract] The frequency dependence of the differential electron mobility and of the longitudinal electron diffusion coefficient in n-GaAs at 300 K is calculated by the multiparticle Monte Carlo method. The calculations are based on the 3-valley model with the coupling between Γ and L valleys weaker than between Γ and X valleys in the 2-valley model and with the effect of X valleys disregarded at low electric field intensities. The results indicate an inertia of intervalley transitions in the range of hot electrons, evidently causing the dispersion of electron mobility at frequencies below 50 GHz, and an inertia of electron energy leveling at frequencies above 50 GHz. Calculated is also the frequency dependence of the d.c.-to-a.c. current conversion efficiency under space-charge limitation. This efficiency is low at low levels of both components E_0 and E_1 of the electric field intensity $E = E_0+E_1\sin(2\pi ft)$, because of the inertia of intervalley electron redistribution. It increases as E_0 and E_1 increase, bacause then the inertia of the drift velocity decreases, until saturation at $E_0 = 20$ kV/cm and $E_1 = 18$ kV/cm. The cutoff frequency, however, never becomes higher than 100 GHz. Figures 3; references 19: 3 Russian, 16 Western. [27-2415]

UDC 621.315.592

HOT ELECTRONS IN MULTIVALLEY SEMICONDUCTORS IN QUANTIZING MAGNETIC FIELDS

Leningrad FIZIKA I TEKHNIKA POLUPROVODNIKOV in Russian Vol 15, No 8, Aug 81 (manuscript received 2 Sep 80, after final editing 16 Dec 80) pp 1568-1574

TOMCHUK, P. M., SYTILINA, N. G., MOVCHAN, Ye. A. and MARTYNCHENKO, V. I., Institute of Physics, UkSSR Academy of Sciences, Kiev

[Abstract] The distribution of electrons in the multivalley semiconductor n-type germanium in a heating electric field and a quantizing magnetic field is analyzed on the basis of theoretical relations and experimental data. Into account is taken the anisotropy of their energy spectrum and of their scattering by acoustic phonons. The equation of quantum kinetics yields an electron energy distribution function consisting of two parts, a symmetric one related to energy only and an asymmetric addition accounting for the presence of the electric field. The solution to the corresponding second-order differential equation, derived for the zero Landau quantum level and extended to the other levels, yields the heating coefficient as a function of energy in the special simple case of parallel electric

and magnetic fields considered here. It further yields the mobility of hot electrons as a function of both electric and magnetic field intensities, also the current-voltage characteristic. On the basis of calculations and experiments, the electron mobility is found to peak at the magnetic field intensity at which hot electrons "escape" into the classical range of energy. The current-voltage curve has a slight peak only, in a magnetic field not sufficiently strong to pull all electrons onto the zero Landau level. The agreement between theoretical and experimental data can be further improved by a more accurate evaluation of the electron energy distribution in the classical range. Figures 3; references 11: 10 Russian, 1 Western.
[27-2415]

UDC 621.315.592

COUPLED SURFACE ACOUSTOELECTROMAGNETIC WAVES

Leningrad FIZIKA I TEKHNIKA POLUPROVODNIKOV in Russian Vol 15, No 8, Aug 81 (manuscript received 18 Dec 80) pp 1575-1578

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[Abstract] Excitation of longitudinal surface electromagnetic waves coupled to longitudinal volume acoustic waves in a piezoceramic crystal is analyzed for two configurations: 1) surface waves appearing at the boundary between a piezoelectric material with a one-dimensional peizoelectric effect and an electron-hole semiconductor with electron drift, 2) surface waves appearing at the boundary between a p-type piezosemiconductor with cubic symmetry and an n-type semiconductor with an electron drift velocity higher than the phase velocity of the surface waves. The external electric field is assumed to accelerate electrons only, their effective mass being much smaller than that of holes, so that they are hotter than holes at approximately the lattice temperature. Calculations are based on the Poisson equation with a one-dimensional peizoelectric effect, which is solved for the frequency and the dispersion law and for the attenuation or amplification in the short-wave range (wavelength smaller than the Debye radius of electrons) and in the long-wave range. Figures 1; references: 3 Russian.
[27-2415]

UDC 621.315.592

THEORY OF LIGHT ABSORPTION BY FREE CARRIERS IN UNIAXIALLY DEFORMED MULTIVALLEY SEMICONDUCTORS

Leningrad FIZIKA I TEKHNIKA POLUPROVODNIKOV in Russian Vol 15, No 8, Aug 81 (manuscript received 7 Jul 80, after final editing 6 Apr 81) pp 1589-1595

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[Abstract] A quantum-mechanical theory is developed for the absorption of light by free charge carriers in a uniaxially deformed multivalley semiconductor. The absorption coefficient is calculated, assuming that uniaxial compression has pulled all electrons into one valley and taking into account the probability of their transition from one state to another near the valley minimum upon interaction with an absorbed photon, also taking into account interaction with absorbed and emitted acoustic phonons. The calculations reveal that in the case of intravelley scattering as well as in the case of intervalley f-scattering (transitions between valleys on different crystallographic axes) or g-scattering (transitions between valleys on the same crystallographic axis) the light absorption coefficient is frequency dependent and its frequency dependence is anisotropic, the difference between its parallel and perpendicular components depending on the temperature, the impurity and the anisotropy of the specimen as well as on the thresholds of intervalley scattering. Specific data are shown for n-Ge, also for n-Si and n-GaP with additional i-scattering caused by dipolarly resolved interband transitions. Tables 2; tables 2; references 7: 3 Russian, 4 Western.
[27-2415]

UDC 621.315.592

DEPENDENCE OF RATE OF A-CENTERS INJECTION INTO N-TYPE SILICON ON ELECTRON BOMBARDMENT INTENSITY

Leningrad FIZIKA I TEKHNIKA POLUPROVODNIKOV in Russian Vol 15, No 8, Aug 81 (manuscript received 4 Aug 80) pp 1598-1600

KOZHEVNIKOV, V. P. and MIKHNOVICH, V. V.

[Abstract] The dependence of the rate of A-centers injection into n-type silicon on the electron bombardment intensity is interpreted here qualitatively on the basis of a simple equation of kinetics for the derivative of A-center concentration with respect to the electron flux density $dN_A/d\emptyset$ as a function of oxygen concentration, acceptor drain concentration, donor drain concentration, rate of vacancies loss on acceptor drain, and rate of vacancies loss on donor drain. While loss of vacancies on formation of E-centers and divacancies is disregarded, Coulomb interaction between charged components of the system is taken into account according to the Debye model. The authors thank V. M. Lenchenko, L. S. Smirnov and A. V. Vasil'yev for helpful discussions of the work. Figures 2; references 15: 9 Russian, 6 Western.
[27-2415]

UDC 621.315.592

PIEZOELECTRIC PHENOMENA IN DISORDERED MATERIALS

Leningrad FIZIKA I TEKHNIKA POLUPROVODNIKOV in Russian Vol 15, No 8, Aug 81 (manuscript received 22 Aug 80) pp 1601-1603

BOROVOV, G. I. and VORONKOV, E. N., Moscow Power Engineering Institute

[Abstract] An experimental study was made of the piezoelectric effect in bulk and film specimens of glassy As_2SeTe_2, $Ge_3Se_2Te_4$, Se and $Ge_{15}Te_{81}Sb_2S_2$. The bulk specimens were cut from ingots, 1-5 micrometer thick film specimens were produced by thermal or high-frequency spray deposition. Measurements were made over the 100-300 K temperature range, a multiturn coil in a strong (1.5 T) nonuniform magnetic field mounted directly under a specimen in the cryostat serving as the vibration detector. Film specimens produced by the high-frequency method were found to yield a stronger acoustic signal than those produced by the thermal method. In all film specimens the acoustic signal was found to weaken with time, because of aging, and to fade or vanish upon annealing at temperatures below the crystallization point, while the electrical conductivity did not change significantly. Only in selenium did the high-frequency (12-20 kHz) acoustic signal remain unaffected by annealing, while the low-frequency signal in it also weakened. The temperature dependence of the acoustic signal was found to be generally nonmonotonic, a sharp increase of the signal with decreasing temperature being characteristic of phase transitions, which is most likely a transition to the ferroelectric state. Figures 1; tables 1; references 6: 1 Russian, 5 Western. [27-2415]

UDC 621.315.592

RESONANT LASER ANNEALING OF RADIATIVE DEFECTS

Leningrad FIZIKA I TEKHNIKA POLUPROVODNIKOV in Russian Vol 15, No 8, Aug 81 (manuscript received 9 Apr 80, after final editing 15 Oct 80) pp 1603-1606

DOLGOLENKO, A. P. and PAVLOVICH, V. N., Institute of Nuclear Research, UkSSR Academy of Sciences, Kiev

[Abstract] Laser annealing of crystal defects is more localized and selective than thermal annealing, also more effective where defects contain light impurity atoms. The latter case is analyzed here, annealing being determined by diffusion processes and the energy spectrum of local impurity atom vibrations being a discrete probabilitistic one. On this basis are calculated the annealing temperature and its decrease due to a decrease in the activation energy. The results are applied to the specific case of resonant laser annealing of A-centers in silicon single crystals. It is demonstrated that the annealing temperature of A-centers in n-silicon can be lowered by a factor of 1.4 by using a laser beam at the

11.98 micrometer wavelength with an intensity Q (erg/(cm^2·s) and a line width α (s^{-1}) such that $Q \sim 10^5 \alpha$. References 6: 2 Russian, 4 Western (one in translation).
[27-2415]

UDC 621.315.592

CHANGE OF LIFETIME OF CHARGE CARRIERS IN $Hg_{1-x}Cd_xTe$ DUE TO ELECTRON BOMBARDMENT AND SUBSEQUENT ANNEALING

Leningrad FIZIKA I TEKHNIKA POLUPROVODNIKOV in Russian Vol 15, No 8, Aug 81 (manuscript received 22 Oct 80) pp 1606-1608

VOYTSEKHOVSKIY, A. V., KOKHANENKO, A. P., LILENKO, Yu. V., PETROV, A. S. and STAFEYEV, V. I., Siberian Physico-Technical Institute imeni V. D. Kuznetsov at Tomsk State University, Tomsk

[Abstract] An experimental study was made to determine the effect of electron bombardment and subsequent annealing on the lifetime of excess charge carriers in p-$Hg_{1-x}Cd_xTe$ (x=0.195) crystals. Specimens 1.5 x 8 x 0.2 mm^3 large were grown by solid-state recrystallization and by zone refining, with a hole concentration of (5-8)·10^{15} cm^{-3}. At T=78 K the hole mobility was 3·10^2 cm^2/(V·s) and the hole lifetime was (1-2)·10^{-7} s. These specimens were irradiated in an electron accelerator with electron fluxes of 10^{15}-10^{18} cm^{-2} with a mean current density of 3 μA/cm^2, in 2.3 MeV pulses of 4 μs duration at a 2.5 kHz repetition rate. Measurements by the Hall method reveal that the dependence of carrier lifetime on the electron concentration generally conforms to the Shockley-Reid model, with the lifetime peaking sharply within the range of intrinsic electron concentration. The dependence of the carrier lifetime and concentration on the annealing temperature indicates that both remain constant until the annealing temperature reaches the level which corresponds to conversion from p-type to n-type conductivity. Figures 3; references 5: 1 Russian, 4 Western (one in translation).
[27-2415]

UDC 621.315.592

NATURE OF DEFECTS IN N-TYPE SILICON IRRADIATED BY HIGH-POWER LASER PULSES

Leningrad FIZIKA I TEKHNIKA POLUPROVODNIKOV in Russian Vol 15, No 8, Aug 81 (manuscript received 8 Dec 80) pp 1620-1622

PRUTSKOV, Ye. G., NIKIFOROV, Yu. N. and YANUSHKEVICH, V. A., Institute of Metallurgy imeni A. A. Baykov, USSR Academy of Sciences, Moscow

[Abstract] An experimental study was made in order to identify the point defects produced in n-type silicon by laser radiation. Specimens of grade KEF silicon with an initial electrical resistivity of 54-60 ohm·cm, oxygen concentration not

exceeding 10^{16} cm^{-3} and dislocation density of 10^2-10^3 cm^{-2} were irradiated by pulses of $5 \cdot 10^{-8}$ s duration from a ruby laser at room temperature, with a total flux density of $6 \cdot 10^8$ W/cm^2 in one test series and $1.2 \cdot 10^9$ W/cm^2 in another test series. The photoconduction spectrum was measured with an IKS-21 instrument through an LiF filter (λ = 1-3 micrometer) at 100 K, before and after irradiation as well as after isochronous annealing at temperatures from 20 to 700°C in 50°C steps. The results indicate that ultraviolet radiation produces defects of the divacancy kind which become annealed at 290°C and more intricate defects consisting of at least two kinds which become annealed at 450-500°C and at 650-700°C, respectively. There can also appear p-n microjunctions. Thus the source of defects produced by the passage of ultraviolet radiation not only can be controllable heavy impurities but also the uncontrollable, present in any crystal. Figures 2; references 10: 9 Russian, 1 Western (in translation).
[27-2415]

UDC 621.315.592

HEAT CONDUCTION IN THIN SEMICONDUCTOR WAFERS IN HEATING ELECTRIC FIELDS

Leningrad FIZIKA I TEKHNIKA POLUPROVODNIKOV in Russian Vol 15, No 8, Aug 81 (manuscript received 19 Jun 80, after final editing 21 Jan 81) pp 1632-1634

PRIMA, N. A. and SACHENKO, A. V., Institute of Semiconductors, UkSSR Academy of Sciences, Kiev

[Abstract] The cooling of charge carriers at the surfaces of a thin wafer of a low-resistivity semiconductor in a heating electric field is analyzed on the basis of the equation of heat balance, with a Taylor series expansion of the temperature profile across the wafer thickness, and energy relaxation during depleting band flexures. Every carrier is assumed to give off its entire excess energy upon reaching the surface. The simple case is considered of cooling at one surface only, with scattering of energy by volume acoustic phonons, and a zero cooling rate at the other surface. Another interesting case is scattering of energy by optical phonons and of momentum by acoustic phonons. Surface cooling can either completely alter the current-voltage characteristic or, without changing the trend of the latter, change the values of the characteristic parameters. Figures 1; references: 10 Russian.
[27-2415]

UDC 621.315.592

RADIATION EFFECTS ON MEMORY ELEMENTS MADE OF GLASSY CHALCOGENIDE SEMICONDUCTORS

Leningrad FIZIKA I TEKHNIKA POLUPROVODNIKOV in Russian Vol 15, No 8, Aug 81
(manuscript received 9 Sep 80, after final editing 2 Feb 81) pp 1635-1637

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[Abstract] Effects of radiation on the characteristics of memory elements made of glassy chalcogenide semiconductors are analyzed on the basis of experimental data. Specimens of AsTe glasses deposited first on a pyroceramic substrate and then on metal electrodes were irradiated with fast neutron fluxes of 10^{17}-$3 \cdot 10^{18}$ cm^{-2} in the VVR-2 water-moderated water-cooled reactor at the Institute of Atomic Energy. Such an irradiation was found to produce several changes in the current-voltage characteristic: to produce a step typical of microbreakdowns within the high-resistance to low-resistance switching range, increase or decrease the forward voltage at a given current in the low-resistance state, lower the switching voltage and the resistivity of the material in the high-resistance state, increase the pulse energy required for switching to the high-resistance state, and transform the current-voltage curve to a straight line corresponding to a low resistance. These changes are attributed here to high-conductivity radiative defects produced in the semiconductor bulk. A higher pulse energy for switching to the high-resistance state is required, because the interelectrode channel existing before irradiation as well as the new channels appearing after irradiation must not be widened. Figures 1; references 10: 2 Russian, 8 Western.
[27-2415]

UDC 621.315.592

ACOUSTOCONCENTRATIONAL EFFECT IN AMPLIFIED SURFACE ACOUSTIC NOISE

Leningrad FIZIKA I TEKHNIKA POLUPROVODNIKOV in Russian Vol 15, No 8, Aug 81
(manuscript received 2 Oct 80, after final editing 2 Feb 81) pp 1637-1639

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[Abstract] An experiment was made in order to confirm the redistribution of free charge carriers away from equilibrium in a semiconductor in a field of ultrasonic noise. On the surface of a CdS crystal oriented for amplification of Gulyayev, Bluestein waves, two orthogonal pairs of electrodes were deposited, one for amplifying the surface ultrasonic noise and the other for probing the interelectrode space during passage of this noise through it. A movable opaque mask on the crystal surface confined a monochromatic illumination (λ = 5150 Å) to specific areas within the interelectrode region, with separate regulation of the intensity. While a voltage above the threshold level was applied across the amplifying electrodes, the voltage pulse across a resistance across the probing electrodes was measured and its variation indicated the corresponding

variation of the electrical conductivity in the region between these two electrodes due to ultrasonic waves. A special test verified that this variation was not caused by the acoustoelectric field at the probing electrodes. Figures 3; references: 5 Russian.
[27-2415]

UDC 621.315.592

LASER ANNEALING OF POINT DEFECTS IN GERMANIUM

Leningrad FIZIKA I TEKHNIKA POLUPROVODNIKOV in Russian Vol 15, No 8, Aug 81 (manuscript received 2 Feb 81) pp 1639-1641

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[Abstract] Experimental data are presented on laser annealing of point defects in germanium single crystals doped with phosphorous or bismuth. The concentrations of the main impurities in the specimens were within the $1\cdot10^{14}$-$5\cdot10^{15}$ cm^{-3} range, the oxygen concentration did not exceed $5\cdot10^{15}$ cm^{-3}, and the dislocation density did not exceed $2\cdot10^{3}$ cm^{-2}. Point defects were produced by gamma-radiation at an intensity of $6.2\cdot10^{12}$ $cm^{-2}\cdot s^{-1}$ from a Co^{60} source at 300 K. The characteristics of unirradiated specimens did not change as a result of laser treatment. Specimens which had retained their n-type conductivity after exposure to gamma-radiation recovered their original characteristics as a result of laser treatment, annealing occurring at a lower temperature than the temperature of thermal annealing. Specimens in which gamma-radiation had effected a conversion from n-type to p-type conductivity did not recover their original characteristics under laser treatment. These results indicate that simple defects (VD-complexes) become annealed by laser treatment through any of three possible mechanisms: ionization of electrically neutral VD-complexes with local states in the valence band, radiation-stimulated migration of highly ionized VD-complexes, and liberation of entrapped interstitial atoms by a shock wave. The authors thank G. Vitali for participating in a discussion of the results and Ye. Kh. Nazaryan for assisting with the measurements. Tables 1; references 3: 1 Russian, 2 Western.
[27-2415]

UDC 621.315.592

FEASIBILITY OF AMPLIFICATION OF SUBMILLIMETER-WAVE RADIATION AT CYCLOTRON RESONANCE OF HOLES DURING INTRABAND OPTICAL EXCITATION OF P-TYPE GERMANIUM

Leningrad FIZIKA I TEKHNIKA POLUPROVODNIKOV in Russian Vol 15, No 8, Aug 81 (manuscript received 3 Feb 81) pp 1641-1644

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[Abstract] The redistribution of lightweight holes in p-type germanium caused by intraband optical excitation is considered, one effect occurring here being

the appearance of a negative conductance at cyclotron resonances of such holes. This effect is analyzed on the basis of an intraband excitation with a CO_2-laser at 77 K and interaction of thus excited with electromagnetic waves. An expression is obtained for the high-frequency electrical conductivity, taking into account the nonparabolicity of the lightweight subband and assuming that the electromagnetic wave propagates in the direction of the magnetic field. Cyclotron-resonance spectra of lightweight holes have been calculated by a numerical analysis of this expression, indicating the feasibility of amplification at frequencies above $1.6 \cdot 10^{13}$ rad/s in magnetic fields stronger than 90 kOe with near-saturation pumping of a CO_2-laser. The author thanks A. A. Andronov for his many helpful suggestions and active discussion of the results. Figures 2; references 16: 7 Russian, 9 Western.
[27-2415]

UDC 621.315.592

SUBTHRESHOLD DEFECT FORMATION IN SILICON CARBIDE UNDER ELECTRON BOMBARDMENT

Leningrad FIZIKA I TEKHNIKA POLUPROVODNIKOV in Russian Vol 15, No 8, Aug 81
(manuscript received 15 Jul 80, after final editing 16 Feb 81) pp 1652-1655

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[Abstract] The effect of electron bombardment of n-SiC (6H) single crystals on their luminescence characteristics was studied experimentally. Polished and etched specimens with $n_d - n_a \sim 10^{17}$ cm^{-3} were bombarded with 4.5 keV electrons at 77 K. Only one of the polar crystal faces $\{0001\}$, the silicon face and not the carbon face, was affected, but not after a specimen had been polished without etching or also etched with subsequent heating at a temperature above 1100°C. The dependence of the luminescence spectra and intensity on the energy of exciting electrons indicates that the centers which govern the changes in the luminescence characteristics lie within the layer of a thickness approximately equal to the depth of electron penetration. Similar effects were found in crystals coated with very thin metal films to form Schottky diodes. According to the results of this study, these changes are due to defective centers within the penetration depth of bombarding electrons. Radiation-stimulated diffusion of genetic defects from the surface to the bulk does not seem to be the cause. Figures 2; references 6: 5 Russian, 1 Western.
[27-2415]

UDC 621.315.592

ANOMALIES OF MAGNETORESISTANCE OF PbTe FILMS

Leningrad FIZIKA I TEKHNIKA POLUPROVODNIKOV in Russian Vol 15, No 8, Aug 81
(manuscript received 13 Oct 80) pp 1658-1659

DASHEVSKIY, Z. M. and KOTEL'NIKOV, V. A.

[Abstract] Single-crystal films of stoichiometric PbTe were grown from the vapor phase on a dielectric substrate, with a flawless structure and the (111) plane parallel to the substrate plane. The dependence of the electrical resistivity on the magnetic field intensity was measured over the 4.2-77 K temperature range, with the film orientation parallel or perpendicular to the direction of the magnetic field. Two anomalies were observed: in "thin" films (thickness comparable to the mean free path of charge carriers) a negative magnetoresistivity in weak transverse magnetic fields, probably due to a superposition of the classical dimensional effect on the transport processes; in "thick" films a saturation of the magnetoresistivity in strong longitudinal and transverse magnetic fields, probably due to a concentration nonuniformity across the thickness. The authors thank V. I. Kaydan for discussion of the work and valuable comments. Figures 2; references 7: 3 Russian, 4 Western.
[27-2415]

UDC 621.382.233.011.222.072.1:53.072.51

QUASI-LINEAR QUASI-ONE-DIMENSIONAL MODEL OF SWITCHING IN P-N-P-N STRUCTURES DURING TRANSIENT PERIOD

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 26, No 7, Jul 81
(manuscript received 8 Nov 79) pp 1498-1509

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[Abstract] The switching process in p-n-p-n thyristor structures is analyzed on the basis of a quasi-linear model. A uniform doping of layers and a quasi-neutrality of the base layers are assumed, also that the lifetime and the mobility of each type of charge carriers as well as the respective diffusion coefficients remain constant, i.e., independent of the injection level. Some empirical relations reduce the problem to a one-dimensional transient problem involving a differential continuity equation with appropriate initial and boundary conditions for the hole concentration and its gradient, and an integral voltage equation. These two equations, together with the equation of electric balance, are solved by a numeroanalytical method involving the use of recurrence relations for the time intervals into which the transient period has been subdivided. Data are shown which depict typical switch-on transients and agree closely with experimental data obtained for a TB-200 structure. The authors thank G.A. Ashkinazi for providing the stimulation, V. A. Kuz'min for the valuable comments and

constructive discussions, and V. P. Grigorenko for the interest in and the attention paid to this study. Figures 6; references 22: 16 Russian, 1 Rumanian, 5 Western.
[34-2415]

SOME ANOMALIES OF PHOTOCONDUCTIVITY OF GaS AND $GaS_{0.5}Se_{0.5}$ SINGLE CRYSTALS WITH RARE-EARTH ELEMENT IMPURITY

Leningrad FIZIKA I TEKHNIKA POLUPROVODNIKOV in Russian Vol 15, No 8, Aug 81 (manuscript received 11 Apr 80) p 1665

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[Abstract] The photoconductivity of GaS doped with Yb, YbS, SmS and $GaS_{0.5}Se_{0.5}$ doped with Yb was measured at 300 and 77 K. Also measured was the temperature dependence of the dark current and the photocurrent in pure and doped $GaS_{0.5}Se_{0.5}$. Regions of impurity photoconductivity in variously polarized light were observed in both materials, but they vanished at 77 K. According to the results of this study, rare-earth element impurities increase the photosensitivity of a semiconductor and extend the photosensitivity spectrum into the long-wave range. No anomalies were found in the dependence of the form of the photoconductivity spectrum and of the magnitude of the photosensitivity on the ionic state of implanted impurities.
[27-2415]

VARIOUS MISCELLANEOUS ITEMS

UDC 538.3:621.333.001.2

MAGNETIC SHIELDING OF HIGH-SPEED VEHICLES WITH ELECTRODYNAMIC SUSPENSION

Novocherkassk IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: ELEKTROMEKHANIKA in Russian No 9, Sep 81 (manuscript received 24 Apr 80) pp 955-959

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[Abstract] The present paper considers a number of problems, among which are investigations concerned with the effect of the curvature of a shield, its edge, the nonlinear properties of ferromagnetic material on the protective properties of shielding systems, and the effect of ferromagnetic shields on the levitation properties of the suspension. For an analysis of the shielding properties there proved to be a suitable spectral approach which permits digressing from the concrete form of the source during a comparison of various systems of shielding. The consideration given to the above items makes it possible to reveal important qualitative regularities and to conduct a comparative analysis of various shielding systems. It is necessary at the same time to note that the investigations conducted far from exhaust all of the variety of problems connected with magnetic protection of the vehicle of a high-speed overland transport (VSNT), and the results obtained can be considered the first step in the path to working out of concrete recommendations for development of systems of shielding as applied to high-speed vehicles using electrodynamic suspension. Figures 1; references 5: 3 Russian, 2 Western.
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